VOL. 18 NO. 1 JANUARY, 1920

THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED

THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER

ELECTRO-PLATERS REVIEW

Entered as second class matter February 10, 1903, at the post-office at New York under the Act of 1879.

A MONTHLY JOURNAL RELATING TO THE METAL AND PLATING TRADES

SUBSCRIPTION PRICE PER YEAR, UNITED STATES AND CANADA, ONE DOLLAR, OTHER COUNTRIES, TWO DOLLARS
THE METAL INDUSTRY PUBLISHING COMPANY, 99 JOHN STREET, NEW YORK

THE METAL INDUSTRY
WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD. COPPER AND BRASS. THE BRASS FOUNDER AND FINISHER AND
ELECTRO-PLATERS REVIEW

Vol. 18 NEW YORK, JANUARY, 1920 No. 1

THE METAL BUSINESS

THE PRODUCTION, DISTRIBUTION, FABRICATION AND RECLAMATION OF METALS.
A SERIES OF ARTICLES COVERING EACH OF THESE BRANCHES AND TELLING HOW THE METAL BUSINESS IS CONDUCTED.

ARTICLE 1. THE PRODUCTION OF COPPER.

A SHORT DESCRIPTION OF THE PROCESSES FOR THE MANUFACTURE OF COPPER FROM ORE TO INGOT
WRITTEN FOR THE METAL INDUSTRY BY ADOLPH BREGMAN, MANAGING EDITOR.

Although THE METAL INDUSTRY does not relate to the field of mining or ore smelting, we have included this subject as a necessary description of an important branch of the copper business.—Ed.

To cover the business of producing copper is to cover one of the world's greatest industries. Next to iron there is more copper produced than any other single metal. In 1918, the production in the United States was about 1,870,000,000 pounds, about 72,500,000 pounds less than 1916, the record year. It is interesting to note that this tremendous business has been developed almost entirely since 1845. Before, the copper produced here was almost negligible; since then it has grown so fast, doubling and tripling itself every ten years, that the total production has amounted to over 28,000,000,000 pounds.

SOURCES OF MATERIAL

Copper ore exists in this country in various localities, the type of ore varying with the localities, to a certain extent. In the Lake Superior region, in northern Michigan, it is found as native copper. This is the origin of the metal which reaches the market as Lake Copper. Other forms of ore are as follows:

Cuprite or Red Oxide of Copper Cu_2O, which contains 88.8 per cent copper.

Tenorite, Black Oxide of Copper, CuO, containing 79.9 per cent of copper. This ore is found in large quantities in the Blue Ridge section of Tennessee, Northern Carolina and Virginia, as well as in the Lake Superior Region. It is of a minor commercial importance.

Malachite—$CuCO_3.Cu(OH)_2$. The basic cupric carbonate containing 57.4 per cent copper.

Azurite—$2CuCO_3Cu(OH)_2$. Basic cupric carbonate containing 55.3 per cent copper.

Chrysocolla—$CuSiO_3+2H_2O$. Cupric Silicate containing 36.1 per cent copper.

Chalcopyrite or Copper pyrites $Cu_2SFe_2S_3$, containing 34.5 per cent copper. This is the most common primary ore of copper. It is the chief copper mineral of the world, and is found everywhere.

Covellite—CuS. Cupric Sulphide containing 66.5 per cent copper; a blue mineral occurring largely in the Butte, Montana district.

Chalcocite—Copper Glance, Cu_2S Cuprous Sulphide, containing 79.8 per cent copper. This ore is found in Butte to a depth of 2,500 feet; also in Cananea and in Arizona; probably the most important ore of copper found in North America, as Montana, Arizona, and many of the Mexican mines base their production upon this mineral.

A most important ore of copper although it contains as an essential constituent no copper at all is Pyrite FeS_2, commonly known as "Iron Pyrites" or "Fool's Gold." Although copper forms no part of the mineral it is almost always found with it, either mechanically contained as a sulphide or in one of the other mineral forms mentioned.

The mining of copper ore is such a tremendous topic and so far out of the field of THE METAL INDUSTRY, that we shall not attempt to go into any detail. It might be of interest, however, to know that it is found in such large quantities and is mined on such a scale, that in many cases it has been found profitable to attack it in the same fashion that the large iron mines are worked, namely, by the open cut method. The magnitude of such an operation is clearly shown by the work of the Utah Copper Company, which has set to work systematically to mine a whole mountain of copper ore. The top layer of soil was stripped off, the ore itself was then broken in benches or terraces and gathered by steam shovels at the rate of forty to fifty thousands tons per day. Needless to say the mining costs on such a basis were very low.

SAMPLING

After the ore has been mined the first consideration is to ascertain its value. In the early days of mining, this was done by picking up a handful here and there, assaying, and estimating that the value of the entire tonnage would be proportional. It is evident that this method was full of errors and discrepancies. It was impossible to run each batch of ore through the mills and smelters separately and to count up the total metallic values extracted. It was impossible not only for practical reasons of inconveniences, but also for metallurgical reasons.

Certain ores could not be smelted without the chemical aid of certain other types. Hence it was necessary to smelt two or three or more kinds of ore at the same time. This made it necessary to devise some accurate, clean-cut method of sampling, for determining the total value of the ore mined. Strictly speaking the term "sampling" means the withdrawal of a small portion from each body in such a manner that the small portion shall represent the entire large body. The business of

sampling was so important, as payments depended strictly upon the assay of the samples, that it grew up into a specialized field of its own. Separate mills were built for sampling only, and numerous sampling devices were invented. Since sampling is of such interest to the metal trades, it may be well to go into a little detail. The methods are as follows:

1.—Hand methods.

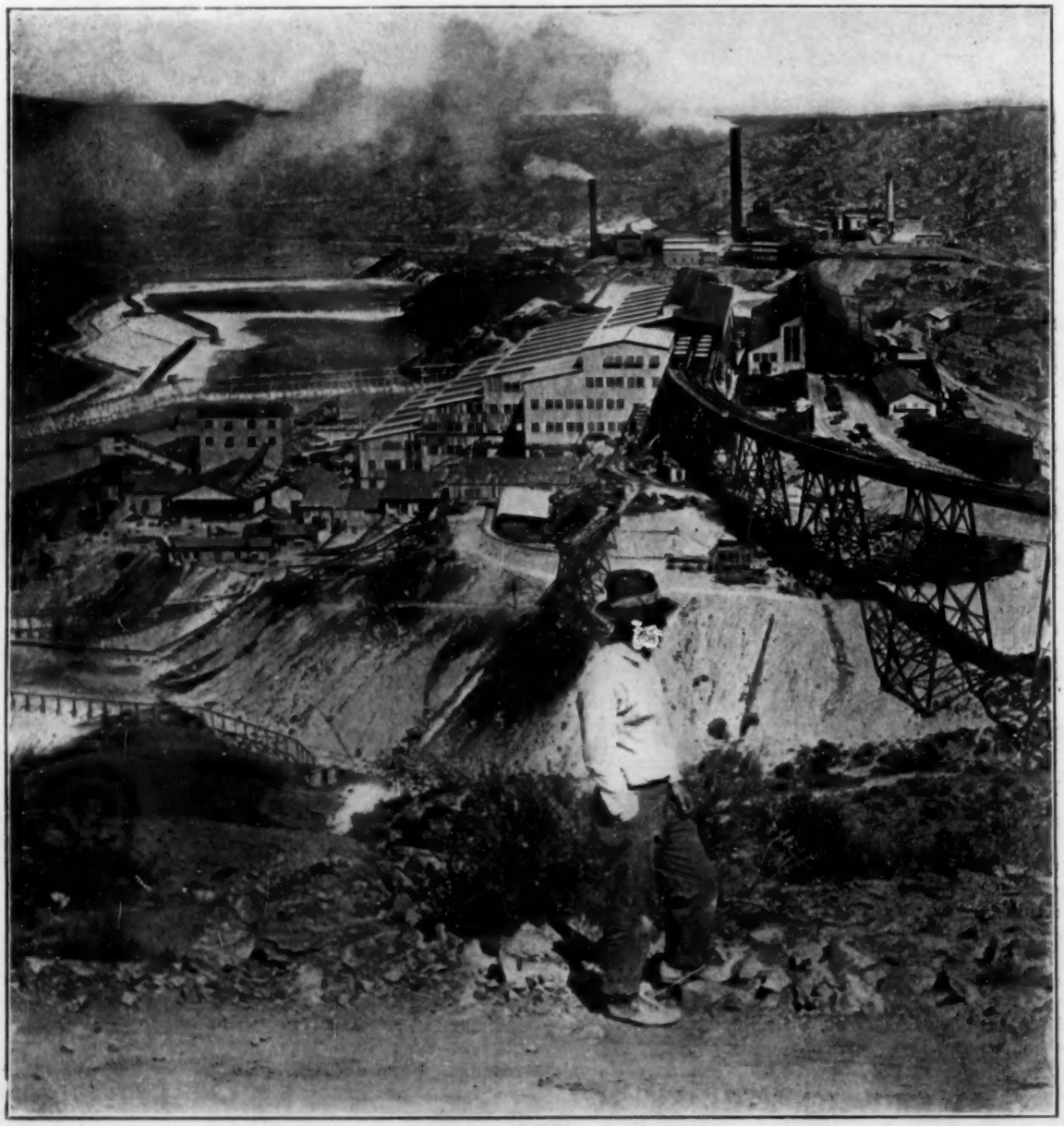
A.—Coning and quartering.

B.—Split shovel.

C.—Riffles.

into a cone, which is again divided into four parts, the one part held out and the other three returned to the storage bin. This process is continued until a sample small enough for assay purposes has been obtained.

One inherent fault of this system is the difficulty of perfect mixing. A cone inevitably sorts the ore, so that the large particles roll to the outside of the heap and the smaller ones remain at the center. This may be partially overcome by piling the cone about a vertical rod and making certain that the cone is so placed as to have the rod for its axis. This, however, demands careful work



Copyright by Underwood & Underwood, N. Y.

A GREAT COPPER SMELTING PLANT AT MIAMI, ARIZONA, WHERE HUGE QUANTITIES OF COPPER ARE TURNED OUT.

2.—Machine methods.

Coming and quartering consists of piling the crushed ore into a large cone, after mixing thoroughly. The cone is divided into four parts, one of these parts taken as a sample and the other three placed in the storage bin. The one part which was held out is again mixed and piled

on the part of the men doing the shoveling, and any one who has had smelter experience will realize that this in itself is a great objection. In addition this method uses much floor space and hand labor. It is practicable only for small and medium sized lots. There is no reason, however, why it cannot be applied to the sampling of

grindings and turnings, providing reasonable care is exercised.

The split-shovel is also a method of sampling small or medium sized lots. It is a very deep shovel, which is composed of a series of parallel troughs alternating with open spaces. It is useful for sampling fine ore, but also has the same objections as the coning and quartering method. The machine methods of sampling are far too numerous to cover in detail. The general principles of the most modern samplers are that a vertical stream of falling material is intercepted at regular intervals by a bucket of some sort, which discharges itself and returns for another sample. The stream should be kept constant in size, and the intervals between the taking of the sample should not be varied.

METHODS OF EXTRACTION

In general the methods of extracting copper can be divided into two parts, wet and dry. The wet method is the solution of the metallic contents by some liquid while the great bulk of the ore remains mostly unchanged. Wherever possible, of course, it is highly desirable as it removes at once the valuable constituents of the ore and eliminates the handling and treatment of as much as 98 per cent of the original material, which can be thrown away at once. As a matter of fact, it is very seldom possible to proceed in such a manner for few ores are amenable to wet extraction. One striking example of ores which can be so treated are those mined in Chicquicamata, Chile, by the Braden Copper Company. There the ore is crushed, leached by sulphuric acid and then deposited electrolytically.

The usual method, however, is that of smelting. The general principle underlying the smelting operation is that the valuable constituents of the ore are heavier than the waste material. When the entire body is melted the copper in its combined form with other minerals (the details of which will be gone into further), sink to the bottom,while the lighter portions or slag float on top. Silver and gold are often present, contained mechanically by the copper and must be extracted during the refining process. The type of smelting operation, of course, varies with the composition of the ore. The copper may occur, among other forms, as an oxide or a sulphide, and will demand a different type of treatment in each case.

CONCENTRATING

In many cases it is found possible to eliminate a large part of the valueless constituents of the ore by what is known as concentrating. This process is very familiar to most foundrymen who have seen Wilfley tables operating on foundry refuse. The same principles are applied in concentrating copper ore. It has to be crushed before running on to the tables, however. The concentrating machines of different types are made for use on material of all sizes, from 2 inch diameter down to slimes which would pass through a 200 mesh screen. In general the large material is concentrated by means of jigs, the medium size by concentrating tables, and the fine material by special slime tables. A comparatively recent development is that of recovering the values by "flotation." The pulverized ore is placed in tanks with water, oil and acid, and the mixture beaten until a heavy froth appears on top. This froth is skimmed off as it contains the metals, filtered, dried, and the "concentrates" smelted in a reverberatory furnace.

A general outline of the process through which copper must go before it is marketable in bar or ingot form is as follows:

1. Crushing.
2. Concentrating.
3. Roasting.
4. Smelting—reverberatory or blast furnace*
5 Converting.
6. Refining.
   a. Electrolysis.
   b. Reverberatory furnace.

ROASTING

The first step in the process of recovering copper by the dry or fire method is that of roasting. This is done essentially for the purpose of eliminating sulphur by oxidizing it to SO_2 and allowing it to escape as a flue gas. Enough sulphur is left in the ore to permit the formation of a little copper sulphide, which sinks to the bottom of the smelting furnace after melting in the form of a "matte." This "matte" includes all of the copper and carries with it mechanically the precious metals.

The early roasting furnaces were operated by hand. The ore was spread thin, and raked from one end of the furnace to the other with long hoes inserted through the walls. The ore was put in at one end of the furnace and gradually raked down to the discharge end. This type, however, is almost extinct. The most common roaster at present is made up of a number of shelves, on which the ore is rabbled by moving arms which operate from a central shaft. It is charged at the top shelf and gradually works its way down to the bottom, where it is discharged.

REVERBERATORY FURNACE SMELTING

From the roaster the ore goes to the reverberatory furnace, where it is smelted and automatically divides itself into two parts. The lower layer is composed of a mixture of copper sulphide, iron sulphide, and any precious metals there may be; the upper, of silicates of iron and other materials in the ore. These are respectively "matte" and "slag." The slag is run off the top and either poured onto the dump in a molten condition, or first granulated by a stream of water.

The matte is tapped off into molds and sent to the converters. It is made up generally of from 35 to 50 per cent copper, the remainder being iron, sulphur, precious metals and impurities. The operation of a reverberatory ore smelting furnace calls for the highest skill. Figuring out the charge must be done with extreme care in order to keep the copper in the matte and not allow it to get into the slag, where it will be lost; also to keep the iron in the slag, and not allow it to dilute the matte. The usual fluxes are iron ore and lime.

Originally these furnaces were very small, holding one or two tons. They have been developed to such an extent that now there is a furnace in operation 147 feet long, smelting 675 tons in 24 hours. These furnaces operate continuously on a 24-hour basis, and do not stop until it is necessary to shut them down for repairs. They are built of brick, the inner liner is silica brick, the outside of ordinary red brick. In places where corrosion is likely, such as the line between matte and slag, a layer of chrome or magnesite brick is sometimes used. As the heat is enormous, they are completely bound with buckstays and tierods, with numerous expansion joints.

They can be fired with coal, coal dust, oil or gas. At one time considerable reverberatory smelting was done with wood, but that has since died out.

---

*If the ore is smelted in a blast furnace it is not previously roasted. If it is smelted in the reverberatory, it is necessary to remove most of the surplus in a roasting furnace

BLAST FURNACES

In many cases it is found advisable to smelt the ore directly in a blast furnace.

The principles of blast furnace smelting, as opposed to reverberatory smelting, are:

1. The blast furnace melts the ore in direct contact with a carbonaceous fuel, while the reverberatory melts the ore by means of heat radiated from a fuel source and the walls of the furnace.

Copyright by Underwood & Underwood, N. Y.

FOURTEEN THOSUAND TONS OF BLISTER COPPER IN PLATE FORM READY FOR SHIPMENT.

2. The blast furnace utilizes the sulphur in the ore itself as a source of heat, while the reverberatory melts the ore down after the sulphur has been removed.

The blast furnace is simply a vertical shaft, which is filled with a mixture of ore, fuel and flux. Air is injected into this mixture and the shaft or ore moves downward or settles as fast as it is melted. It is charged from the top through doors; the blast and furnace gases are carried through a hood to a stack; the furnace operates continuously, as does the reverberatory. The heat is so high that instead of fire brick walls the modern practice is to have the furnace sides, which are in direct contact with the charge made up of steel water jackets. Water flows continuously through these jackets and the condition of the furnace can be judged to a certain extent by the temperature of the water. As fast as the charge is melted, it flows continuously into an exterior settler, the bottom and sides of which, like the bottom of the blast furnace, are made of silica brick. The air for blast furnaces is supplied by low pressure blowers, operating at from ten ounces to three pounds.

In general, blast furnace smelting is divided into two types: Pyritic and Partial Pyritic smelting.

Pyritic smelting is the reduction of sulphide ores to matte and slag using minimum outside fuel. The constituents of the ore are capable of producing almost all the heat necessary for fusion. Partial pyritic smelting is done with the aid of from 10 to 15 per cent of coke, which supplies the heat which the ore itself lacks.

As a matter of fact, the most important blast furnace method of the day is undoubtedly the partial pyrite smelting, simply because ore bodies with uniformly large percentage of sulphides are rare. Most of the ores found require the addition of coke to produce the heat necessary for smelting.

In addition to the coke, lime is necessary as a flux. If the charge is especially refractory, iron ore in limited quantities is also added. By combining with the silicious portion of the ore, they go into the slag as silicates.

BLAST FURNACE VERSUS REVERBERATORY

The question arises always in the construction of a

new plant, whether to smelt the ore in a blast or reverberatory furnace. Roughly they may be compared as follows:

REVERBERATORY

1. Typically suited to very fine material.
2. Sulphides must be roasted.
3. Does not require power for blast.
4. Generates steam from its waste heat.
5. Cost of fire brick, refractory materials and repairs is very high.
6. Varied types of fuel and inferior grades can be used.

BLAST FURNACE

1. Not suited to very fine material.
2. Demands no roasting of sulphides, but uses them as fuel.
3. Requires power for blower to supply air.
4. Waste heat is lost, but very much less in quantity than that produced by the Reverberatory.
5. Lower cost of installation.
6. Larger tonnage smelted.
7. Simple operation.
8. Comparatively low fuel consumption.
9. Produces much flue dust.

As regards the cost of smelting, this is more or less in doubt. Under most conditions, the blast furnace operates more cheaply than the reverberatory, but recently the very large reverberatories, using pulverized coal as a fuel, have been operated more cheaply than blast furnaces.

The question resolves itself entirely into one of local conditions.

CONVERTING

The matte produced by the blast and reverberatory furnaces is taken to converters, which resemble somewhat in appearance the Bessemer Converters for producing steel. In these converters air is blown through the molten matter until all, or almost all, the sulphur is oxidized to SO^2 and a 95 to 98 per cent "Blister Copper" is produced. The slag is returned to the blast or reverberatory furnace for re-smelting, as it is often very rich. Wherever possible the matte is charged into converters in a molten condition directly after tapping from the smelting furnace. These converters may be lined either with silica brick or basic brick.

REFINING

After the copper has been poured from the converters it has 95-98 per cent copper content. In addition to this, it contains gold and silver and a small percentage of impurities. Lead, arsenic, bismuth, iron, zinc and sulphur and nickel have been almost entirely removed. However, the remaining two per cent of impurities are still sufficient to make the copper unfit for electrical purposes or for rolling. In order to remove these the copper goes through the following process.

1. Casting into anodes.
2. Electrolytic refining.
3. Final refining in a reverberatory furnace.

The first step, that is the casting into anodes, is simply melting down and casting into large plates with lugs or ears at the top for handling in an electrolytic bath. The electrolyte is acid copper sulphate.

The object of electrolytic refining is primarily to recover the copper, free from the numerous impurities which make it unworkable. In addition, the gold, silver and platinum and other valuable metals which may be contained therein, are also recovered, as they drop to the bottom of the electrolytic tanks in the form of a sludge.

ADOLPH BREGMAN.

Electrolytic refining can be carried on, under either of two systems; the multiple system in which the anodes and cathodes are hung respectively in parallel and the series system in which they are hung in series. Relative advantages of the two are as follows:

MULTIPLE SYSTEM

1. Copper of any quality can be treated.
2. Lower voltage required.
3. Lower cost for labor, as more mechanical appliances can be used.
4. Less scrap is produced in stripping deposited copper.
5. Less care required in conducting the operations.

SERIES SYSTEM

1. Lower cost of installation.
2. No special cathode plates required.
3. Greater output per tank.

The multiple system is in much more extensive use, and the tendency seems to have been for it to displace the series system almost everywhere.

Tanks are built of wood and lined with either lead or asphalt. In the multiple system the anodes which are large and heavy are placed in the tank in large numbers by means of automatic cranes. The cathodes, which are smooth rolled copper sheets, about ¼ inch thick, are handled the same way. The electrolyte is an acid solution of copper sulphate, running about 15 to 20 per cent copper sulphate crystals and about 5 to 10 per cent sulphuric acid, with a density of about 1.25. Considerable difficulty is experienced in keeping the solution clean because of the numerous impurities in the anodes. The electrolyte is kept constantly moving, in some plants running from tank to tank by gravity, and then being pumped back to the head tank by acid-proof pumps of antimonial lead. The bath is usually maintained at a temperature of about 90 to 100 degrees Fahr. The current density varies widely in different places, averaging between 10 and 15 amperes per square foot; voltage .1 to .3.

The sludge or slimes contain all the impurities. The deposited copper which is almost chemically pure is stripped off and sent to the final refining furnace. Here the cycle of operations may be divided as follows:

1. Charging.
2. Melting.
3. Skimming.
4. Oxidizing.
5. Poling.
6. Casting.

This series of operations is completed in 24 hours and the amount of copper turned out in that period depends entirely upon the size of the furnace. Several refineries now have furnaces which hold 300 tons of metal. For furnaces of this size charging is almost always done by machinery. A full-sized charging machine can handle as much as 200,000 pounds per hour, and takes the place of 17 men.

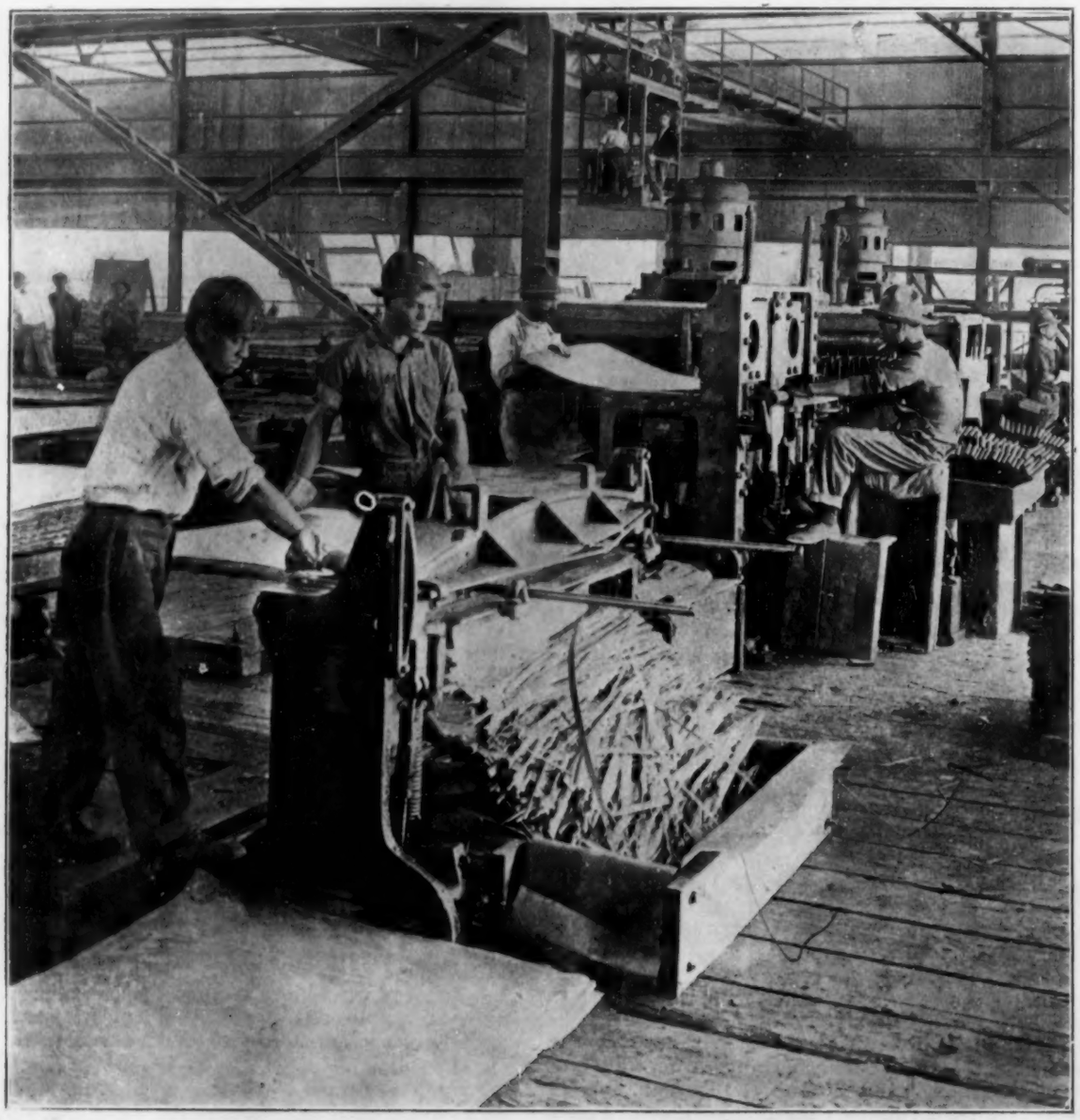
The reasons why it is necessary to put electrolytic copper through another process are:

1. In order to get it into marketable form, such as bars or ingots.
2. Copper so nearly pure cannot be used for drawing into wire because it is too brittle.

It seems necessary for copper to include cuprous oxide to between .4% and .8%. If the metal is turned out too pure it must be reoxidized and brought back to proper pitch by poling. This is the process that must be gone through by electrolytic copper. After being melted, it must be oxidized. A certain amount of this oxidation takes place during the melting down of the charge; slag forms and rises to the surface of the bath, which must be skimmed; then follows a vigorous oxidation which is effected either by blowing air through the bath of molten copper, at a pressure of 20 to 25 pounds per square inch, or by "flapping" the metal back and forth with long handled iron paddles. When this has gone far enough, which is usually when the copper includes about 6 per cent of cuprous oxide, poling is begun. This point is discovered by taking a button sample of the metal, which shows a concave surface. When this button is broken, a single bubble is found at the apex, the copper being hard and brick red. It is known as "set copper" or "dry copper."

Poling is carried on by pushing long wooden poles into the bath and fastening them in place until they are burned away. This causes a violent boiling of the metal, and a dry distillation of the wood, during which the hydrocarbons of the wood reduce the cuprous oxide of the copper. When the copper has reached the "tough pitch" condition it is ready to cast. The tough pitch is recognizable by the silky texture of fracture, the rose pink color, and the flat face of the button on cooling. It is necessary to keep the metal in this condition during the casting operation, and this calls for the highest skill on the part of the refiners.

The copper is cast into bars or ingots and is then ready for the market.



TRIMMING THE EDGES OF SHEETS OF PURE COPPER FROM THE ELECTROLYTIC TANKS.

A FEW ALLOYING PROBLEMS

SOME DIFFICULTIES ENCOUNTERED AND THEIR SOLUTION.

WRITTEN FOR THE METAL INDUSTRY BY JESSE L. JONES, METALLURGICAL EDITOR.

Brass castings of the type shown in the sketch (see Fig. 1) often give considerable trouble by blowing when the steel rod is inserted into the brass casting. The blowing of the steel rods is probably due to the presence of rust or scale; even the very thin scale produced by the blueing of steel will cause blowing.

The rods should be carefully pickled in dilute sulphuric acid, washed in hot water until free from acid and dried quickly. They should then be coated with a solution of alcohol and rosin made up from about 5 pounds of rosin to 1 gallon of alcohol. The molds should be poured soon after the rods are set If the molds are closed and allowed to stand any length of time, moisture may condense on the rods and when the molten brass reaches this it will be changed to steam, thus causing a blow.

JESSE L. JONES.

It should be remembered that the steel rod will rapidly chill the molten brass, making it sluggish and causing it to set quickly. Hence the mold should be well vented. Quick melting of the brass and clean fluid metal that has not been allowed to "soak" in the furnace is also desirable. Overheated, oxidized metal will contain dissolved gases, that may cause trouble.

For the casting shown, a 5/16 inch square copper clad steel rod could be used. If this material is clean and bright it may be possible to use it without any coating whatever. However, a coating of the alcohol and rosin is desirable, even on copper clad steel, especially if the rods are not used for several days after they are cleaned.

CHAPLETS

The use of chaplets is not so extensive in brass foundries as it is in iron foundries. Just as many iron foundries cast their own chaplets from cast iron, because the molten iron lies well on such chaplets; brass foundries may cast their chaplets from cast copper. A majority of brass foundries, however, use copper wire for chaplets, selecting wire of suitable diameter for the castings to be made and cutting it into pieces of the length required. If desirable, the ends of these wires can be easily upset. Copper nails of a variety of sizes are on the market and some brass foundries use these nails for chaplets.

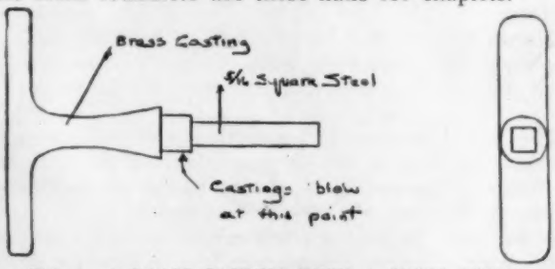


FIG. 1. A BRASS CASTING WITH A STEEL INSERT.

The majority of brass castings are small and the large ones made are not elaborately cored like cast iron cylinders and similar iron castings, that require so many chaplets. Undoubtedly a line of one piece double head copper chaplets would be of considerable interest to brass foundries. The reason why copper wire and copper nails are so generally used at present is no doubt owing to the fact that there are no suitable copper chaplets on the market.

As a coating of verdigris readily forms on copper which would cause blowing if found on a chaplet, it would be advisable to pickle, wash in hot water and coat with a thin layer of some protective coating. A clear lacquer of good quality or solution of rosin or shellac in alcohol would be suitable. Giving the chaplets a thin coating of tin would also be satisfactory.

HIGH LEAD BRASS

The writer saw yellow brass castings with which a firm had had considerable trouble for years. They came only in orders of 100, but they had to be absolutely perfect. They had been poured hot and medium, but upright and flat. They had tried glass and other fluxes. Of course charcoal, and sometimes dry sand, was used. The mixture of the castings was 65.6 copper, 26 zinc, 8.4 lead. Other mixtures such as 30 copper, 15 zinc, and 65 copper, 34 zinc, and 1 lead had been tried, with no better results.

This mixture was, of course, very high in lead content, and segregation of the lead was likely. The following mixture was suggested: copper 76, lead 2, tin 2, zinc 26. The sample castings of the 65.6-26-8.4 mixture presented a very good appearance but on breaking them they were found to have shrink spots in the middle section. It is advisable to gate the castings at such a point using a heavy gate so as to feed the part of the casting that shows up porous.

ELIMINATING IRON FROM BRASS

It is often necessary to eliminate iron from alloys which run about 1 to 1½ per cent in an alloy of copper 85, tin 10 lead 5. Brass scrap containing considerable iron is generally oxidized in the reverberatory furnace. Any zinc present is burned out and most goes up the stack while the iron is oxidized and forms a silicate slag, if sufficient sand is present. Silicious washings are generally smelted with irony brass, thus forming a slag that will contain both the iron oxide and some zinc oxide. Lead and tin will be thrown down. The slag can be smelted in the blast furnace or water-jacketed cupola for further values as it may contain shot metal.

When the iron in a brass alloy does not exceed 1½ per cent and there is little zinc present, melting in an ordinary open flame oil burning furnace of the Schwartz or some similar type, is sufficient to remove practically all of the iron with very little loss of the other metals. The furnace should be run with an excess of air to facilitate the removal of the iron. The reverberatory furnace and blast furnace are better adapted for this work, especially if a large tonnage is to be handled. Where such equipment is not available, however, and the brass founder possesses an open flame furnace it will be found to be very satisfactory.

Where iron is well alloyed its presence in a brass is not at all objectionable unless the percentage is high. Iron up

to .50 per cent will add strength and if a little phosphorus is present to prevent its oxidation it will do no harm. If an alloy contains no more than 1½ per cent of iron it can be used up a little at a time and if melted in a Schwartz furnace the increase in the iron content of the final metal will be scarcely noticeable.

ELECTRIC HEATING FOR GALVANIZING OR ZINCING KETTLES

The electric heating of all hot galvanizing kettles would be most desirable. These kettles are usually heated at present with gas house coke, natural gas or oil, and as a result large volumes of carbon monoxide gas are produced. It is not possible to put a stack on a galvanizing kettle to carry away the products of combustion as the draft produces such a high temperature that the molten zinc rapidly destroys the kettle. The writer recalls a self-sufficient manager who insisted on putting a smoke-stack on his first kettle and in a few days he faced the problem of removing thirty tons of zinc from the ashpit.

The carbon monoxide gas produced by the combustion of the fuel is very poisonous. Very large buildings with considerable head-room and extremely good ventilation are necessary in galvanizing plants.

Not only does electric heating of hot galvanizing kettles do away with all poisonous fumes but it prolongs the life of the kettles by reason of its uniformity and close regulation. The buildings do not have to be as high and are consequently less expensive.

Electrically heated sherardizing drums have been on the market for some time, and it is said that sufficient work has been done in the electric heating of hot galvanizing kettles to warrant the expectation that they will soon be for sale. In some preliminary tests, in addition to the advantages mentioned above, it is claimed that the use of electric heat has been actually found cheaper than coke, gas or oil.

ALUMINUM AND MAGNESIUM

An alloy of 93 per cent aluminum and 7 per cent magnesium will produce very light and strong castings. It casts well and machines well. If somewhat less strength is admissible and greater toughness is wanted, a smaller proportion of magnesium may be used. Manganese is best added to aluminum alloys in the form of a manganese-aluminum alloy. It is possible, of course, to make an alloy from aluminum and ferro-manganese, but it will contain enough iron to make it unfit for most uses.

An alloy of magnesium 92 per cent, aluminum 8 per cent has been patented by Pistor & Rakowicz, of Frankfort on the Main, Germany (U. S. Patent 965,485) July 26th, 1910. This alloy is said to have a specific gravity of only 1.95 and to be quite strong. It has been used for airship parts and similar ware.

THE ALUMINUM INDUSTRY IN 1919—OUTLOOK FOR 1920

What Has Been Accomplished in the Readjustment of Peace.

Written for The Metal Industry by Aluminum Man.

The aluminum industry in the first few months of the year 1919 was seriously affected by the necessary readjustment due to the close of the war and the cancellation of many Government contracts. This situation resulted in an accumulation of a very large stock of ingot which, however, has had the beneficial effect of ample supply for all purposes.

The stocks of manufactured products throughout the country, such as cooking utensils, tubing, bronze powdar, automobile parts, etc., were unusually low. Consequently, shortly after the beginning of the year the demand for these materials resumed its pre-war situation. The result has been that the rolling mills and other factories turning out finished products have been busy practically throughout the year. Owing to the ample supply of ingot, the shipments of aluminum have been made with less delay than has been the case with other metals.

The demand for aluminum has been stimulated somewhat by the numerous uses to which it was put during the war and to other natural developments. A striking example of the latter is in the case of the automobile industry where the tendency is toward the manufacturing of enclosed bodies. Aluminum sheet is admirably adapted for this purpose, and as a consequence of the large manufacturing program of the many automobile companies aluminum sheet has been in active demand. Similarly bronze powder found a wide use as a protective paint during the war, and this demand has also maintained itself during the year.

The electrical conductor business, which was almost at a standstill during the war, has revived to a very satisfactory volume.

Practically all of the fabricating mills of the United States have been increased. The Aluminum Company of America, the principal producer of aluminum, reports the erection of a new rolling mill at Alcoa (Maryville), Tennessee, which, when completed, will be one of the largest in the country. It further reports that its rolling mill at Edgewater, N. J., is being very much extended, and a large cooking utensil factory is being erected at the same place. There is even an indication that the increased rolling mill capacity which has been put into use during the year 1919, and that which will be effective during 1920, will amply take care of the demand for aluminum sheet, which has been particularly strong in recent months.

It is also reported that the Aluminum Company of America is increasing its foil mill at New Kensington, Pa., to meet the rapidly growing demand for aluminum foil, the many advantages of which have brought it prominently to the fore in competition with the higher priced tin foil. Its equipment for the manufacture of aluminum moulding is also being enlarged to meet the demand for moulding in the aluminum automobile body business.

Manufacturers will be gratified to hear of these increases in the fabricating mills, since shortage of fabricated material has been acute during the latter part of the year just closed.

The labor situation in connection with the aluminum business has been relatively steady during the year, and the industry has not been affected to any marked extent by the steel strike nor by the coal strike.

There have been no marked advances in the industry in the way of inventions nor changes in practice during the year 1919. In this connection, however, it may be of interest to note that the manufacture of duralumin in the United States has now been undertaken by The United States Aluminum Company, which is producing this material in the form of sheets, rods and other forms of fabricated material.

TYPICAL FOUNDRY PROBLEMS

A Description of some Pattern Designs and Other Work in Metal Foundries, Written for The Metal Industry by William J. Reardon, Foundry Editor.

One very interesting foundry problem that came up in the experience of the writer was the casting of a 3,500 pound bronze gear blank, 48 inches in diameter, with a rim 8 inches by 8 inches, and an 11-inch diameter, 4-inch cored hub. The gear blank had to be made of the 88 copper, 10 zinc, 2 tin bronze. It was to have four arms. There was also a question whether to cast it solid or split.

It was decided to cast it solid, using a cast iron chill on the outside rim, and gates and risers as shown in Figure 1. The casting temperature was about 2100 deg. F. A rough casting for the chill was sufficiently accurate.

WILLIAM J. REARDON.

Another case of the same sort was a simple-looking casting for a cylinder 30 inches in diameter, outside, 5½ inches long 28 inches in diameter inside. The pattern shown in Figure 2 was designed to take care of shrinkage and allow for a ¾-inch finish.

MONEL METAL VALVE DISCS

A foundry had been having trouble making valve discs of monel metal, using regular monel metal shot. Shrinkage cracks and pinholes constantly came in. The castings were from four to twelve inches in diameter and weighed from eight to one hundred pounds each. They had been casting them without risers and a gate, fourteen inches of pressure gate being at the rim of the disc.

They were advised that the best results in casting monel metal are obtained when the molds are made in dry sand and gated preferably at the bottom with a horn gate when possible. Gate similar to aluminum bronze, using risers or chills. The metal is best melted in an air furnace or electric furnace. The electric furnace would be more satisfactory.

A good flux to use for monel metal is four ounces uranium alloy to the hundred pounds. This can be furnished by the Stand Chemical Co., Pittsburgh, Pa.

CASTING BRONZE IN IRON MOLDS

Many casting shops have tried to cast bronze in permanent molds. Especially, they have tried to cast

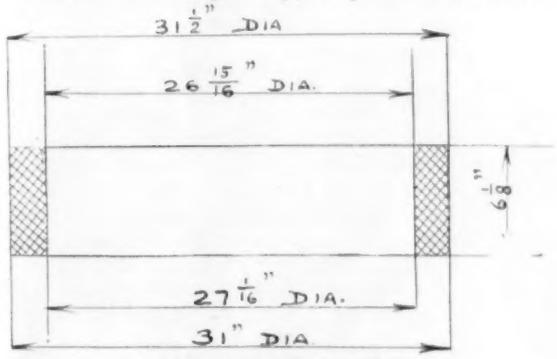


FIG. 2. CAST CYLINDER.

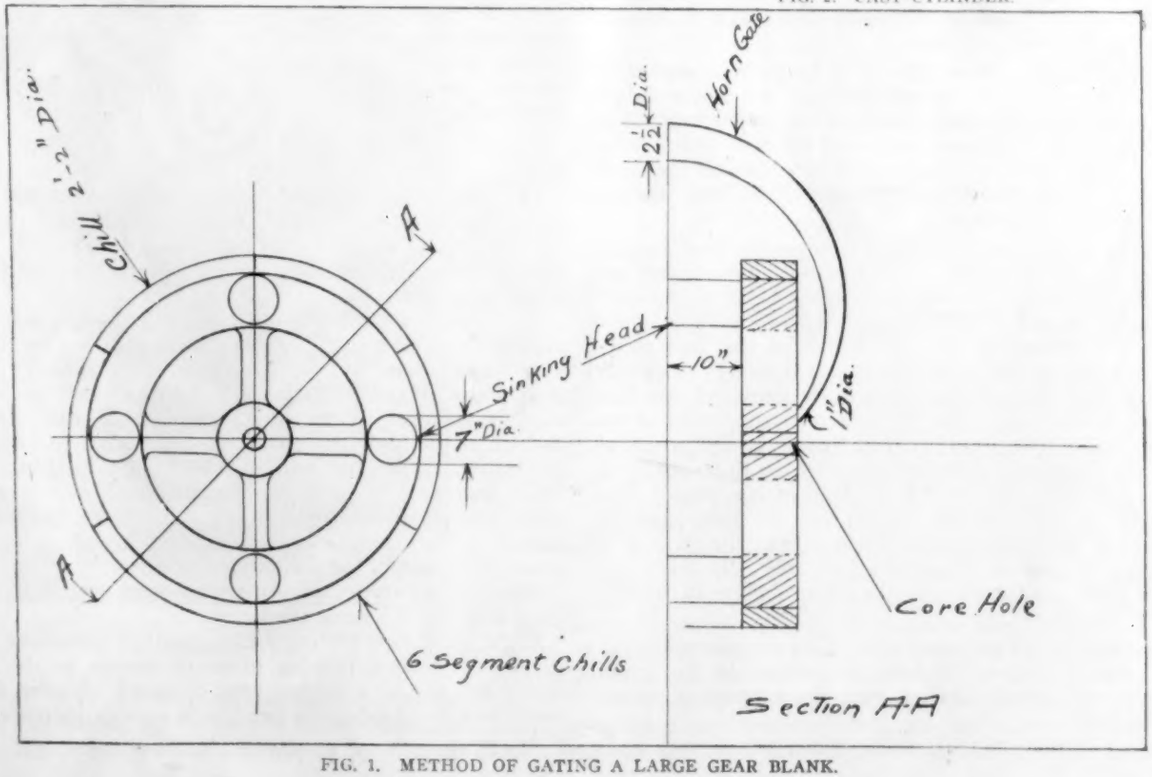


FIG. 1. METHOD OF GATING A LARGE GEAR BLANK.

bearing bronzes in this fashion. So far, however, the only alloys that are successfully cast in the bronze series in cast iron molds or permanent molds are aluminum bronze, manganese bronze, or Tobin bronze.

Unfortunately these alloys are not suitable for bearings or bushings. However, considerable experimenting is now going on along this line both in the permanent mold for bearing bronze and the forging of bronze bushings, a process that will have a big future.

As yet there is no successful method of casting bearing bronze of small sizes. However, when the proper iron alloy to cast the mold from is discovered, bronze bearings will be cast in permanent molds.

RE-LINING CAR BRASSES

A customer has sent in to a metal worker a few hundred car brasses from which the metal lining has been worn, requesting that they reline them.

The brasses came to them very greasy, but they had little or no trouble in tinning the wearing surface. When they came to pour the lead-antimony lining, it failed to adhere to the tinned surface of the brass. They used 40 tin, 60 lead solder for tinning purposes.

They were advised that there should be no trouble with a lead antimony babbitt adhering to a tin surface, but that the trouble was in the trimming of the bearing.

In preparing a bearing for lining it is best first to remove all the old lining from the car brass, cleaning thoroughly of all dirt, oil, or any foreign substance, burn over a slow fire and clean with gasoline or sand blast, (the idea being to remove from the surface all scale and oxide). Then heat the car brass to a temperature that when water is sprinkled on it the water will evaporate readily. Swab over the surface to be tinned with a piece of woolen waste dipped in solder flux consisting of one part zinc and three parts muriatic acid, then rub over the surface to be tinned with half and half solder. Be sure to have a good coat.

Babbitt used for car brasses generally consists of 87 lead and 13 antimony, and should adhere to a tinned surface without any difficulty, unless the babbitt contains zinc or arsenic, as these will cause trouble.

MOULDING BRONZE PROPELLERS*

BY C. T. CLEVE.

At Mare Island Navy Yard there are occasional requirements that one seldom meets in commercial foundry practice. The following is intended to explain how a number of large propeller blades are being molded in the brass foundry at that place. The job is somewhat unusual as to size of the blades, and also due to the fact that the face of all blades must be true to pitch and be machine-finished. Each blade is five feet long and as wide as it is long, three blades being cast on a hub three feet deep. The pattern is quite thin and, as is generally the case, only one blade pattern and hub are furnished.

Several plans were considered to hold the pattern in position while ramming the sand to the underside, and the following was adopted:

A ring was cast about eight feet in diameter and eight inches deep, with a flange on both top and bottom edges six inches wide, the ring having arms and a hub. The top flange was machined true, and the hub bored for a spindle step. The top flange was also drilled for three dowels at equal spaces, and for several tap bolts, the use of which will be explained.

This cast iron ring is bedded down in the floor and the spindle set in the center. The pattern hub is now set over the spindle, and a three-cornered piece of two-inch lumber which had previously been fitted to the face of the blade, and extending the full width of the face is secured by screws from the top, and a dowel in the lower edge set into one of the three holes provided for that purpose in the ring. The blade is now supported at the hub by the spindle as is usual and over the full width of the blade four feet from the center by the three-cornered piece resting on the finished surface of the ring. Two or more tap bolts are now placed through holes made in the pattern and tapped into the ring, and the pattern is now secured against the molder's rammer. In this manner the mold can be made hard without danger of springing the pattern.

The usual copes are used and before the pattern is removed, the screws which held the pattern to the three-cornered support are backed out; the support is drawn separately and the space it left in the sand two inches wide is rammed up.

The support can be again placed on the pattern in the same position as before and again set into the next dowel hole. The three blades are made in this way with each at the same angle. No time is lost by the molder leveling or tramming.

A large bolt is now screwed into the ring between each blade, and the whole mold secured by the use of binders to the ring below.

Several of these wheels have lately been cast, using the above described method, and each blade is at the proper angle. They are spaced correctly, and are in every way a satisfactory job.

It may be interesting to some, to add that the metal in these wheels is manganese bronze, an alloy composed of from 38 to 40 per cent zinc, having a trace of tin, lead, iron, aluminum and manganese, and the balance copper. When properly alloyed this metal exceeds both in strength and elongation the more common grades of carbon steels.

*Clippings, California Foundrymen's Association.

TAPS FOR BRASS

Q. We are having considerable trouble with the taps we are using on brass goods. Advise us the best steel to use and if you would advise using high speed steel. We have trouble with the taps expanding or shrinking 0.005 in the tempering.

A. The best steel to use for tapping brass is one containing from two to three per cent. tungsten, but other wise having the same composition as an ordinary high carbon steel that is with from 1.15 to 1.25 carbon. This steel if uniform in its composition, will contract or shorten at the highest and lowest limit 0.002" per inch in hardening. When hardening it should be heated to about 1,525 degrees F. Good grades of English and Swedish steels are very uniform and are suitable for tap manufacture. They nearly always expand in tempering instead of shortening or shrinking.

Some newer types of American steel which is very good also has the same tendency.

High speed taps are especially good for automatic machines, only when tapping brass or bronze as the machines are run at a higher rate of speed. Under these conditions the production per tap is greatly increased.—P. W. B.

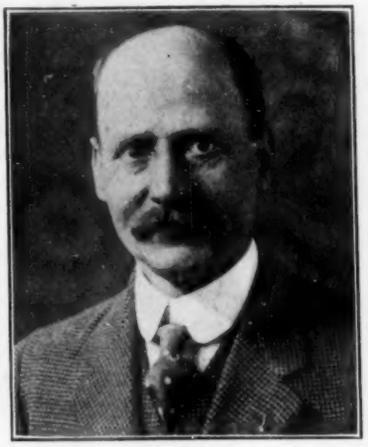
THE OXY-ACETYLENE PROCESS OF BRAZING AND WELDING METALS

AN EXPLANATION OF THE PRINCIPLES AND PRACTICE OF OXY-ACETYLENE WORK AS APPLIED TO METALS OUTSIDE OF IRON AND STEEL.

WRITTEN FOR THE METAL INDUSTRY BY PETER W. BLAIR, MECHANICAL EDITOR.

The process of fusing and uniting metals by the application of intense heat without compression or the use of a flux is termed "autogenous welding." The temperature required is obtained by the combustion of gases such as oxygen and acetylene or oxygen and hydrogen.

The first oxy-acetylene welding or brazing torch that came to the United States was sent from France in February, 1904. The invention of the oxy-acetylene torch is generally credited to Le Chatelier in the year 1895, but it remained undeveloped until in 1901 Fouche and Picard produced a torch or blow-pipe employing both acetylene and oxygen under high pressure. There proved to be objections to this type of torch in practical use.



PETER W. BLAIR.

In 1906 the Gaultner-Ely torch was introduced which is a positive or medium pressure type which used both gases under moderate and independent pressure affording

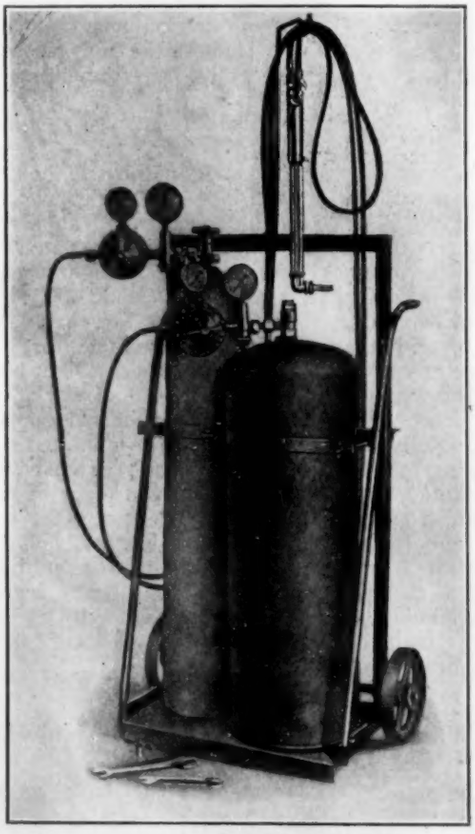


FIG. 1. COMPLETE PORTABLE WELDING OR BRAZING OUTFIT.

control of both gases, maintenance of proportions and effective mixing of the gases. Since that time it has been greatly improved and developed by the different manufacturers of welding and brazing apparatus in the States by producing mechanical welding and brazing devices which have proved their superiority. Fig. 1 shows a complete portable welding or brazing outfit; welding or brazing torch, hose and connections, oxygen and acetylene reducing and regulating valves with pressure gauges, oxygen and acetylene tanks with compressed gas and truck.

To become proficient in the art of autogenous welding requires experience and practice, but a knowledge of some of the fundamental principles will enable the operator to make more rapid progress. It is advisable to begin by welding thin strips of sheet brass, copper or aluminum not over ⅛" in thickness. If comparatively thick materials are to be welded the edges should be beveled at an angle of 30° or any other way as required. (See Fig. 2 for edges beveled and brazed). The beveled surfaces are then heated by the concentration of the flame in a circular form. Whenever fusion occurs metal should be added from a "welding rod" the composition of which is suitable for the work in hand.

To fill blowholes or defective parts in brass or copper castings which will develop in all well regulated foundries manufacturing non-ferrous metal castings, at times more especially in core work and at times not developed until a large expense has been put on the casting in the machine-shop, the procedure should be the following:

The casting should be preheated to 400° F. below the melting point. The flame is then concentrated by a circular movement of the torch. Whenever fusion occurs

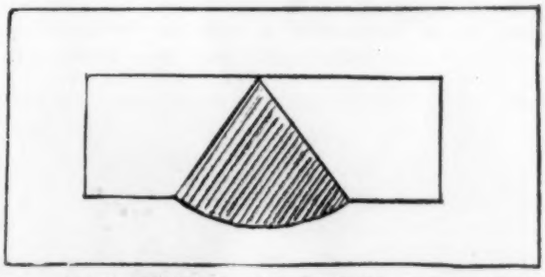


FIG. 2. EDGES BEVELED FOR BRAZING THICK MATERIAL.

new metal should be applied from a welding rod, the composition of which is nearly the same as the alloy of the casting. The heat is then radiated from the brazing or welding rod to the work, whereas if the metal were allowed to drop through the flame it might be burned and injured. When the defect or blowhole is filled it is advisable to pass or concentrate the torch over it so that all parts will cool from a nearly uniform temperature.

Aluminum that is to be welded should be scraped and cleaned and if the stock is more than ¼" thick it is advisable to chamfer the edge. The oxy-acetylene flame can be reduced or "softened" by using an excess of acetylene to a degree which will be indicated by the extension

of the acetylene cone from 1 to 1½ beyond the white cone. This excess of acetylene does not injure aluminum but lowers the flame temperature which is desirable when welding aluminum. Before welding this metal, preheat the entire piece in a charcoal fire or gas furnace to about 300 degrees below the melting point. Then cover it with asbestos or other such material leaving an opening where the weld is to be made in order to keep the work hot until weld is completed. When the weld is made it should be covered completely against drafts or cold air to insure slow cooling and prevent shrinkage cracks. Many aluminum parts can be welded without pre-heating such as lugs or projecting pieces broken off completely. When a welding flame is applied to aluminum it will be noticed that the metal does not run together. A flattened iron rod should be used to puddle the aluminum and this rod should be wiped frequently so that it will not become coated. The rod should not be allowed to reach a red heat, thus causing oxide of iron to form on it, as this would cause a defective weld. A good aluminum flux will be found advantageous. The aluminum to be added should be sticks of special composition obtainable from the makers of welding apparatus. The quality of the welding metal has much to do with the quality of the weld.

In welding brass keep the point of the white flame away from the weld slightly, according to the thickness of the pieces so that the heat will not be sufficient to burn the copper in the brass or volatilize the zinc. If a white smoke appears remove the flame as this indicates excessive heat. A little powdered borax should be used as a flux. For brass welding it is advisable to use a tip about one size larger than is specified for steel of the same thickness or weight. As the weld is cast brass it will not have the tensile strength of rolled sheet brass.

To weld copper the same kind of flame can be used but a much larger tip for radiating. Pre-heating is necessary when a large piece of copper is to be welded as otherwise so much heat from the torch will be dissipated by radiation that little will be left for fusing the metal. Copper will weld at about 1,900 degrees F. hence the flame need not have so high a temperature as for steel or iron, and it must not be concentrated on so small a surface. On account of the radiation, however, the total quantity of heat must be greater. Welded copper has the strength of cast copper but can be rendered more tenacious by hammering. The radiation of heat from copper can be

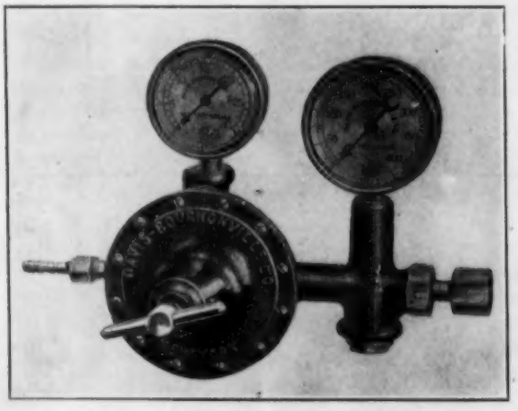


FIG. 3. PRESSURE REGULATOR.

considerably lessened by covering it with asbestos sheets while heating.

To weld copper to steel first raise the steel to a white heat (the welding point) then put the copper in contact with it and the two metals will fuse together. When the copper begins to flow withdraw the flame slightly to prevent burning.

The oxy-hydrogen and oxy-acetylene flames are especially adapted to cutting large brass or copper castings that are to be remelted such as large copper tanks and kettles, brass propeller wheels, etc. The thickness of metal that can be cut depends largely upon the gases used and the pressure of the oxygen; the thicker the material the higher the pressure required. When using

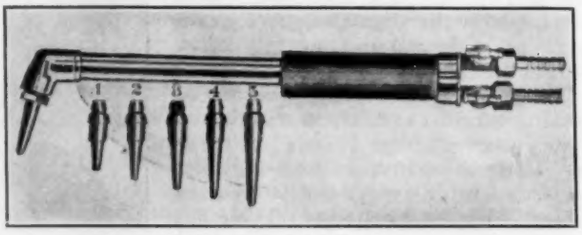


FIG. 4. WELDING TORCH WITH EXTRA TIPS.

the oxy-acetylene flame it might be practicable to cut brass or copper 12″ thick whereas with the oxy-hydrogen flame the thickness could be increased to 24″ or 30″. The oxy-hydrogen flame will cut thicker material principally because it is longer than the oxy-acetylene flame and can penetrate further to the full depth of the cut.

Both gases are necessarily supplied in the tanks under a high pressure to take care of all classes of work in the actual process of cutting and welding and the pressure is reduced by regulating and reducing valves equipped with gauges that register both the high pressure and the reduced working pressure, the regulating valves maintaining the desired working pressure. Fig. 3 shows the Pressure Regulator. The oxy-acetylene flame has a temperature of approximately 6,300° F. When properly produced this flame is small and neutral, neither oxidizing nor carbonizing, and is applied with a pencil-point concentration. It is in this concentrated application of the properly proportioned high temperature flame that the great value of the process lies. The highest temperature of most fuel furnaces is about 3,000° F., and of the oxy-hydrogen flame something less than 4,000° F.

Fig. 4 shows a welding-torch, suitable for medium sheet metal work and repair work where a light compact, nicely balanced tool is desired for general work.

This process has now been adopted for many operations so successfully that it can be found of unlimited use in a brass manufacturing plant. It is now extensively used for welding sheet copper and brass in place of riveting when finish and rigidity are required; also for welding copper and brass pipe joints and lengths, doing away with threated joints for tubes, welding for uniting parts difficult of casting, cutting risers from heavy brass castings, reclaiming broken or worn and defective castings or parts of aluminum, brass, bronze and all metals of either light or heavy sections.

PICKLING.*

Q. What is a good pickling solution to use in tumbling?

A. Sulphuric acid, about one quart to 50 gallons of water.

A. & B. People in Cleveland used tartaric acid in water for tumbling for years and have received good results. Nitre cake ought to prove to be a good thing, especially if a little gravel or some abrasive of some kind was added.

*The Monthly Review, A. E. S.

THE DEPOSITION OF SILVER AND CADMIUM*

A Valuable Combination of These Metals That Can be Used to Reduce Plating Costs of Articles of the Novelty Type as Well as Electric Fixtures, Art Goods, Etc.

Written for The Metal Industry, By Charles H. Proctor, Plating Editor.

The extremely high price of metallic silver at the present time has caused investigations by many manufacturers to determine which of the commercial metals could be used to advantage in connection with silver to lower the cost without any detriment to many articles of manufacture now plated with pure silver.

CHARLES H. PROCTOR.

In December, 1914, pure sheet silver was quoted at 49⅝ cents per troy ounce. Nov. 25th, 1919, the price was $1.37½ per troy ounce and it is possible that the extreme limit has not been reached. Many foreign countries will no doubt adopt nickel in place of silver for many coins on this account. Italy has recently placed a very large order in this country for nickel blanks to replace one of their silver coins, and others may follow as silver has passed its parity of 16 to 1 as compared with gold. It makes but little difference whether silver or nickel is used for coins so long as the purchasing power remains the same.

We have paper money of denominations from one dollar to a thousand dollars, yet intrinsically the paper upon which the printing is applied to give the paper its nominal value is not worth as much as a nickel blank to which a denominating factor of 25 cents might be applied. The adoption of nickel coinage in the place of silver then for a period would help to equalize the law of supply and demand and keep the white metal at a parity with gold.

Cadmium is not an unknown metal although it has not been used to any great extent. Possibly its high cost of a few years ago prevented its use as an alloy in the production of Sterling Silver. In 1914 the metal was quoted at $2.50 per pound. Its present price is $1.40 per pound.

In the manufacture of Sterling Silver it renders the alloy more malleable and decreases the blow holes in castings. It is used in the production of dental alloys, silver solders, etc. In the form of the double cyanides the metal can be used to an advantage in Cadmium plating. The cyanides of cadmium are the most valuable salts to add to silver solutions. The manufacturers of the well known Trisalyt Salts of Gold, Silver, Copper and Zinc have recently put on the market a Cadmium Trisalyt, which will be found an excellent combination to add to silver solutions for the deposition of Silver and Cadmium. The component parts are the same as with the other salts. Sodium Cyanide, Cadmium Cyanide and Sodium Sulphite.

Metallic cadmium is soft, quite non-corrosive, not readily tarnished by sulphureted hydrogen fumes, and is of a white color but not as white as silver. It can be polished to a high lustre. The specific gravity of cadmium is 8.67. Its melting temperature is 610 deg. Fahr. as compared with 7.00, the specific gravity and 786 deg. Fahr. the melting temperature of zinc. The metal alloys well with gold, silver and copper. The source of metallic cadmium is almost exclusively as a by-product in the smelting of zinc. Many zinc ores contain it, and when the zinc is distilled from the retort in which the ore is reduced the cadmium being the more volatile comes over first. The product, however, contains some zinc, and must be subjected to a further distillation to remove it. Cadmium although whiter than zinc and possibly a greater factor as an anti-corrosive metal in the protection of iron and steel will not replace the latter metal for the purpose on account of its high cost, when compared with the low price of zinc.

Experiments that have been recently made in the deposition of silver and cadmium prove that an alloy of 75 parts silver and 25 parts cadimum still resembles silver in its white color, it has a distinct advantage over a pure silver deposit or even sterling silver, that it does not tarnish as readily.

Therefore a finished article plated with silver and cadmium will remain brighter for a greater length of time. When cadmium is added to a regular silver cyanide solution the metal content of the solution should be determined by analysis and then cadmium cyanide or cadmium trisalyt added to bring up any percentage of the two metals desired. Of course, it will be necessary to remove a part of the silver solution so that the metal content per gallon of the combined metals will not be in excess of the metal content of the solution in form of silver only previous to adding the cadmium salt. It will be found difficult to prepare a cadmium cyanide. Platers who desire to prepare their own salt will find it much easier to prepare a cadmium carbonate. However, cadmium cyanide or cadmium trisalyt will be found as previously stated the most efficient salts to use.

Cadmium carbonate can be prepared as follows: For each ounce of metallic cadmium, three and one-third ounces of strong nitric acid and the same amount of fluid ounces of water. Add the cadmium in small proportions at a time preferably in the form of small strips of sheet cadmium. When the metal is all dissolved about 10 fluid ounces of water should be added to the sodium nitrate and then heated to a boil. Four ounces of 58% Soda Ash dissolved in hot water will be required to precipitate each ounce of cadmium converted as outlined. More, however, may be necessary to precipitate all the cadmium as a carbonate.

The precipitated carbonate should be washed several times to eliminate all the sodium nitrate held in solution. When blue litmus paper no longer shows a trace of change in color the operation is complete. For every ounce of cadmium converted to the carbonate 2½ ozs. sodium cyanide will be required to convert to the double cyanide of cadmium, and give a slight excess of free cyanide. The sulphate or chloride of cadmium may also be converted to the carbonate; cadmium sulphate contains a little less than 15% metal; the chloride contains 50%. These compounds vary in their metal content due to the variable amount of water of crystallization. Nickel in the form of nickel cyanide is being used to some extent in connection with silver to lower the cost of the deposited metal.

*In December, 1911, an article on "The Electro-Deposition of Cadmium," by Emmanuel Blasset, Jr., appeared in The Metal Industry.

However, nickel does not deposit readily from a cyanide solution. It has been claimed that from 25% to 30% nickel has been deposited with silver. However, when an analysis had been made of the combination silver and nickel deposit it was found that only 5 per cent of nickel had been deposited. Yet the amount of nickel in the form of nickel cyanide constantly added and with the use of nickel anodes that showed a fairly good reduction would imply that more nickel is actually deposited with the silver than found in the analysis. Cadmium, however, is without a doubt the ideal metal to use with silver.

For an ordinary deposit of silver and cadmium the following formula will give excellent results.

Water—1 gallon.
Sodium Cyanide—2 ozs.
Silver Cyanide—1⅞ ozs.
Cadmium Trisalyt—2½ ozs.
Caustic Potash—¼ oz.

The above formula contains approximately 75 parts silver and 25 parts cadmium or 2 ozs. of the combined metals per gallon of water. A solution that was recently tried out based upon only one ounce of the combined metals upon a 50% basis of each metal gave excellent results. Very little difference in the colors of the deposit was noted as compared with silver.

The solution used was composed as follows:

Water—1 gallon.
Sodium Cyanide—¾ ozs.
Silver Cyanide—⅝ ozs.
Cadmium Trisalyt—2½ ozs.
Caustic Potash—88%-92%-¼ oz.

It is not necessary to use any higher voltage than for regular silver solutions. Not in excess of one volt. For heavy deposits the above proportions may be increased. For some purposes Cadmium alone will be found satisfactory. In such an event the following formulas may be used.

Water—1 gallon.
Sodium Cyanide—5½ ozs.
Metallic Cadmium converted into the carbonate as outlined—2 ozs.
Caustic Potash—¼oz.

Voltage one. Temperature of solution 160 deg Fahr. or

Water—1 gallon.
Cadmium Trisalyt—8 ozs.
Sodium Cyanide—½ oz. Tem. Normal at 1 volt.
Caustic Potash—½ oz.

If small additions of silver in the form of silver cyanide dissolved in an equal amount of sodium cyanide and as little water as possible for solution, is added to the above formulas the deposit will be considerably whiter than cadmium. Anodes for silver and cadmium plating should be equal to 85 parts silver 15 parts cadmium. For cadmium plating anodes of pure cadmium should be used.

Deposits of silver and nickel or silver and cadmium are not susceptible to the commonly termed oxidized methods which, in reality, when the sulphur combination is used upon silver, is a sulphide, not an oxide of silver.

If the oxidized effect so called is desired upon articles plated with silver and cadmium then it is advisable either to coat the articles in a regular silver solution for a minute or two or flash the articles so plated in a warm copper cyanide solution for a few moments. The articles may then be oxidized with regular polysulphide solutions and finished in any of the popular finishes in vogue for silver.

Although cadmium has been used but very little in the years past as a valuable commercial metal there is no doubt that the future will establish its proper sphere with other commercial metals in the field of electro deposited metals.

METAL PLATING

A Compilation of Tables Showing the Time Required to Deposit a Given Thickness of Copper, Part 3.

Written for the Metal Industry by W. G. Knox, Associated with the Chemical Laboratory of the Western Electric Company, Inc.

This article presents the third of a series of tables showing calculations of the length of time necessary to deposit different metals in various given thicknesses out of solutions commonly used in electroplating. The table shown here refers to the deposition of copper from its solution in which the valence of the metal is considered as one. The alkaline cyanide bath is probably the most important example of this type.

In making calculations for the time necessary to deposit the various thicknesses of copper, it is necessary to know the rate at which the metal may be deposited. This rate of deposition depends not only on the efficiency of the plating operation but on the nature of the plating bath as well. Thus under proper conditions, the cynide copper solution will turn out exactly twice the weight of copper per ampere-hour as the acid copper solution.

The amount of metal in grams per ampere second i.e., the electro chemical equivalents, is as follows:

Copper (cyanide)—.0006588 gram
Copper (sulphate)—.0003294 gram

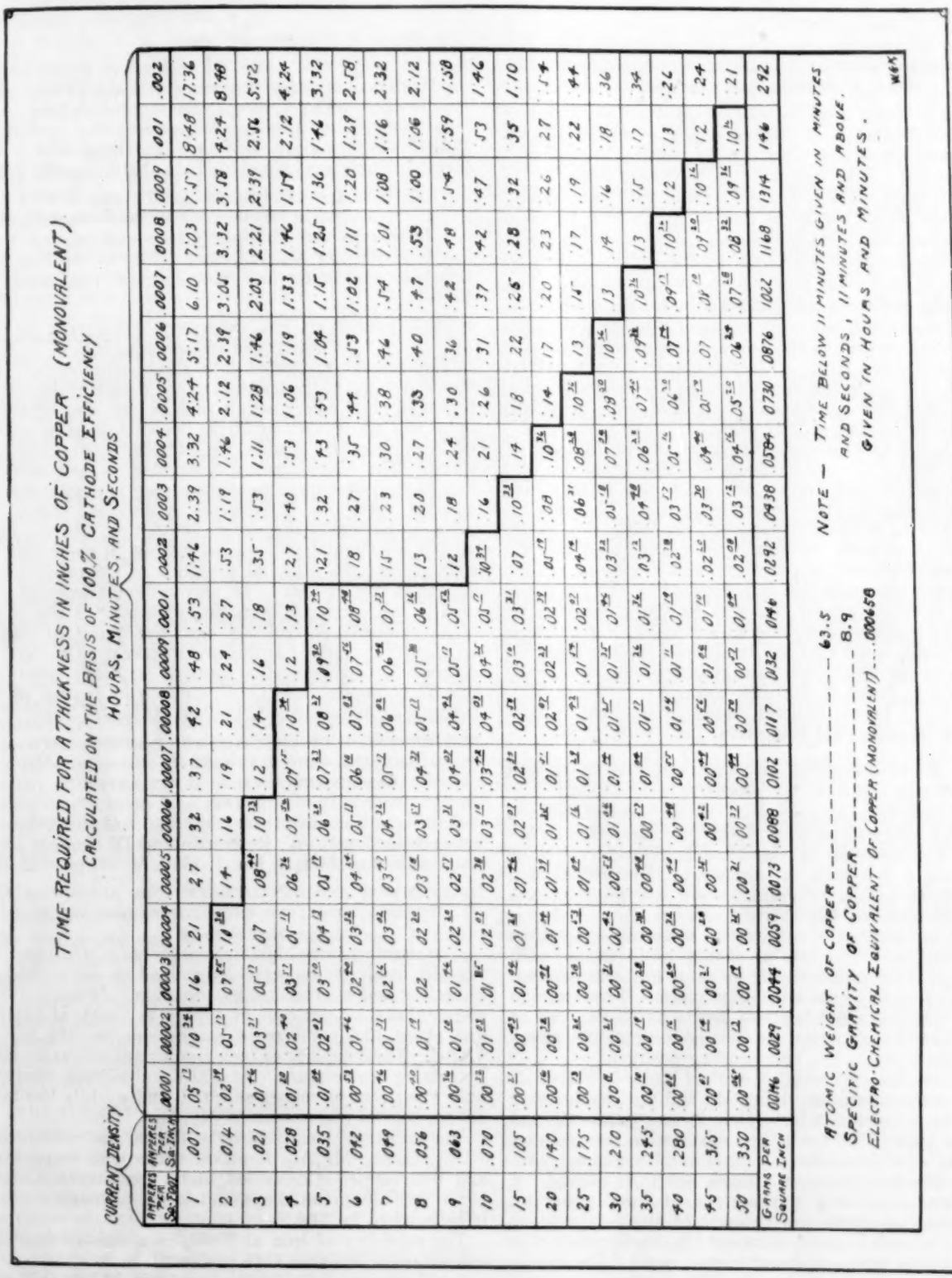
The fundamental reasons for this difference in the rates of deposition are explained in any standard text books on the subject of electroplating.

The cyanide solution is extensively used in connection with copper plating iron, steel, zinc, etc., as these metals normally will not take a satisfactory deposit from the acid sulphate solution. Many plating plants use the cyanide bath mainly as a means of applying a preliminary coating of copper to objects which are then removed, carefully rinsed and given a heavier plate in the acid copper bath. In some cases, such as casting of iron or steel, even the cyanide is not particularly satisfactory because of the tendency of the plated goods to show spots or discolorations frequently after being so finished. For a preliminary coating on this kind of material a nickel flash is often given.

The working of a cyanide bath should receive careful attention from the plater. While striving to obtain the highest current suitable for good work, care should be exercised in keeping the current below the violent gassing stage. The latter simply means the loss of plating efficiency which may at times amount to not more than forty or fifty per cent. The amount of current per unit cathode area or the current density varies with the manner in which the solutions are maintained.

A properly kept cyanide bath will work much more satisfactorily than one which is not looked after and in addition permit of higher current density. This in turn will shorten the time for the work to remain in

the bath. The plater, therefore, should adjust the current to the particular requirements of his class of work.



TIME REQUIRED FOR A THICKNESS IN INCHES OF COPPER (MONOVALENT)
CALCULATED ON THE BASIS OF 100% CATHODE EFFICIENCY
HOURS, MINUTES, AND SECONDS

CURRENT DENSITY

AMPERES PER SQ. FOOT	INCHES PER SQ. INCH	.0001	.0002	.0003	.0004	.0005	.0006	.0007	.0008	.0009	.001	.002
1	.007	05 12	10 24	16	21	27	32	37	42	48	53	1:46
2	.014	02 36	05 12	07 48	10 24	14	16	19	21	24	27	53
3	.021	01 48	03 24	05 12	07	08 36	10 24	12	14	16	18	35
4	.028	01 24	02 48	03 36	05 12	06 24	07 48	09 36	10 24	12	13	27
5	.035	01 12	02 24	03 36	04 48	06	06 24	07 36	08 24	09 36	10 48	21
6	.042	00 54	01 48	02 48	03 36	04 24	05 12	06	07 12	08 48	10	18
7	.049	00 48	01 36	02 24	03 12	03 48	04 36	05 12	06	06 48	07 36	15
8	.056	00 42	01 24	02	02 48	03 36	04 12	04 48	05 24	06	06 36	13
9	.063	00 36	01 12	01 48	02 36	03 12	03 48	04 24	05	05 36	06 12	12
10	.070	00 30	01	01 42	02 24	03	03 36	04 12	04 48	05 24	06	10 48
15	.105	00 18	00 36	01 12	01 48	02 24	03	03 36	04 12	04 48	05 24	07
20	.140	00 12	00 24	00 48	01 36	02 12	02 48	03 24	04	04 36	05 12	10 36
25	.175	00 06	00 18	00 30	00 42	01 06	01 30	01 54	02 18	02 42	03 06	04 30
30	.210	00 06	00 12	00 24	00 36	00 48	01	01 24	01 48	02 12	02 36	05 12
35	.245	00 06	00 12	00 18	00 30	00 42	00 54	01 18	01 42	02 06	02 30	04 48
40	.280	00 06	00 12	00 18	00 24	00 36	00 48	01	01 24	01 48	02 12	04 24
45	.315	00 06	00 12	00 18	00 24	00 30	00 42	00 54	01 06	01 30	01 54	03 48
50	.350	00 06	00 12	00 18	00 24	00 30	00 36	00 48	01	01 18	01 42	03 24
GRAMS PER SQUARE INCH		.0046	.0029	.0044	.0059	.0073	.0088	.0102	.0117	.0132	.0146	.0292

ATOMIC WEIGHT OF COPPER ---------- 63.5
SPECIFIC GRAVITY OF COPPER ---------- 8.9
ELECTRO-CHEMICAL EQUIVALENT OF COPPER (MONOVALENT) ..... .000658

NOTE — TIME BELOW 11 MINUTES GIVEN IN MINUTES AND SECONDS, 11 MINUTES AND ABOVE, GIVEN IN HOURS AND MINUTES.

.0003	.0004	.0005	.0006	.0007	.0008	.0009	.001	.002
2:39	3:32	4:24	5:17	6 10	7:03	7:57	8:48	17:36
1:19	1:46	2.12	2.39	3:05	3:32	3:58	4:24	8:48
53	1:11	1:28	1:46	2:03	2:21	2:39	2:56	5:52
40	53	1:06	1:19	1:33	1:46	1:59	2:12	4:24
32	43	53	1.04	1:15	1:25	1:36	1:46	3:32
27	35	44	53	1:02	1:11	1:20	1:29	2:58
23	30	38	46	54	1:01	1:08	1:16	2:32
20	27	33	40	47	53	1:00	1:06	2:12
18	24	30	36	42	48	54	1:00	1:58
16	21	26	31	37	42	47	53	1:46
14	18	22	26	31	35	39	44	1:10
12	16	20	23	27	31	35	39	1:18
11	14	17	20	23	26	29	33	1:06
10	13	16	19	22	25	28	31	1:02
09	12	15	18	21	24	27	30	1:00
08	11	14	17	20	22	25	28	56
07	10	13	16	18	21	24	26	52
07	10	13	15	18	20	23	25	50
0730	0584	0730	0876	1022	1168	1314	146	292

THIS TABLE SHOWS THE RATE OF DEPOSITION OF COPPER FROM CYANIDE SOLUTION.

The above table amply covers the various thickness of plate usually applied to work by the jobber or manufacturer. For those who are not able to interpret the table accurately the writer would refer them to the articles accompanying tables 1 and 2 published in the June and August issues of this magazine. Table No. IV will show calculation for the deposition of copper from the acid or sulphate solution.

THE YEAR'S PROGRESS IN METALS

A Review of the Most Important Work Conducted in the United States and England on Metals and Alloys.

Written for The Metal Industry by One of Our Staff.

A COMPARISON OF GRAIN SIZE MEASUREMENTS AND BRINELL HARDNESS OF CARTRIDGE BRASS.

1. The grain sizes of the annealed alloys 68 Cu. 32 Zn. and 69 Cu. 31 Zn., agree closely when the previous heat treatment and reduction by rolling are made to correspond. The difference in thickness 0.374 m. (9. 4 mm.) gage and 0.130 in. (3.3 mm.) gage, does not appreciably affect the grain size or the Brinell hardness.

2. The grain sizes of brasses annealed at low temperatures are greatly affected by the grain size and the reduction by rolling previous to such annealing.

3. The grain size and Brinell data for the several conditions described, when plotted against temperature, give curves that approach the curve of metal annealed after hard rolling as a limit. It is desirable to select for standard of grain size (as determined by the temperature of annealing) those specimens that have been previously reduced by rolling at least 50%.

4. In the case of cartridge brass of the composition 68 Cu., 32 Zn., Brinell hardness indicates grain size. At low annealing temperature the grain size is influenced by the grain size of the previous anneal. The finer the grain size of the previous anneal, the more closely will the curve, Brinell hardness, grain size, approach the standard curve.

5. Since the grain size is influenced by the grain size in the previous anneal and also by the amount of reduction by rolling previous to annealing, the hardness of cartridge brass may be determined with greater accuracy by the Brinell hardness measurement than by attempting to judge if from the grain size. W. H. Bassett & C. H. Davis, Bulletin American Institute of Mining and Metallurgical Engineers, Jan., 1919, p. 57.

EFFECT OF TEMPERATURE, DEFORMATION AND GRAIN SIZE ON THE MECHANICAL PROPERITIES OF METALS.

The variations in properties of the amorphous and crystalline phases of any substance are referred to as follows. The cohesion of the amorphous and crystalline phases of a substance is discussed. Recrystallization seems to be caused by grain growth and grain growth does not seem to take place until a temperature is reached at which the amorphous phase is softer than the crystalline. The rate of change of expansion with change of temperature should be great in the amorphous phase and small in the crystalline phase. The temperature at which a metal becomes brittle on cooling can be made lower by changing the arrangement of the amorphous phase into a less commanding position.

If a non-allotropic metal is worked below its recrystallization temperature, its elongation and tenacity increase below the temperature at which it was deformed and decrease above it up to the recrystallization temperature. The rate of deformation of the amorphous phase with a given absolute cohesion is much less than that of the crystalline phase at a temperature of equal cohesion. Adjustment of atoms and removal of strain take place after an annealed metal is cooled; in hard metals this change will be slow and in soft metals rapid. The mechanism of rupture is discussed. The results of several hundred tests on copper, tungsten and iron at temperatures between 190 degrees and 900 degrees to 1,000 degrees C. are discussed. A brief note is given dealing with the interpretation of the properties of complex alloys. A suggestion as to the method of attack on the solid solution mystery is given. A copy of this paper may be obtained by writing to the secretary of the American Institute of Mining Engineers. Zay Jefferies—Bulletin of American Institute of Mining and Metallurgical Engineers, No. 146, Feb., 1919, pp. 575-578.

GRAIN GROWTH IN ALPHA BRASS.

This investigation supplements or confirms work done by Mathewson and Phillips, Jeffries and others. F. G. Smith in Bulletin No. 152, Aug., 1919, of the American Institute of Mining and Metallurgical Engineers, pp. 1361-1388.

FOURTH REPORT TO THE CORROSION COMMITTEE OF THE INSTITUTE OF METALS.

The report is divided into three main parts. The first is devoted to the question of the nature of the actions that take place where metals such as zinc, copper, aluminum, and alloys such as 70:30 brass, corrode in neutral or nearly neutral liquids, e.g. distilled water and seawater. The second section is devoted to the consideration of the behavior of condenser tubes in similar liquids, and the variations in behavior in different samples of tubes of nominally the same composition. In the third section an attempt is made to set out in some detail a statement of the practical problems of corrosion, which appear to the authors to be very different from what is usually supposed. A preliminary account is also given of experiments carried out with the object of testing an electrolytic (the Cumberland) process of protection. A preoxydizing protection process is briefly described. Guy D. Bengough and O. F. Hudson in Journal of the Institute of Metals, No. 1, 1919, V. 21, pp. 37-252.

THE PROPERTIES OF SOME ALLOYS OF COPPER WITH ALUMINUM AND WITH MANGANESE, AND WITH MANGANESE AND ALUMINUM BUT WITHOUT ZINC.

Castings made under pressure rolled and physical properties determined. W. Rosenhain and D. Hanson, Journal Institute of Metals, No. 1, 1919, V. 21, pp. 255-274.

CONSTITUTION AND METALLOGRAPHY OF ALUMINUM AND ITS LIGHT ALLOYS WITH COPPER AND WITH MAGNESIUM.

The temperature-solubility curves of $CuAl_2$ and of $Mg4Al_3$ in aluminum were determined by the method of annealing and microscopic examination. Aluminum dissolves about 4.2 per cent of copper as $CuAl_2$ at 525°C., and about 12.5 per cent of magnesium as Mg_4Al_3 at 450°C. The solubility of both compounds decreases with decreasing temperature. At 300°C., aluminum dissolves only 1 per cent of copper as $CuAl_2$ and slightly less than 5.9 per cent of magnesium as Mg_4Al_3.

The structural identification of the various constituents $FeAl_3$, $CuAl_2$, Mg_4Al_3, found in alloys with magnesium and with copper is described, and a constituent is noted in all light aluminum alloys containing magnesium which is believed to be Mg_2Si.

The solubility of iron as $FeAl_3$ in aluminum is at all temperatures less than 0.15 per cent.

Small amounts of silicon up to from 0.12 to 0.20 per cent are dissolved by aluminum at the eutectic temperature but are reprecipitated upon cooling corresponding to the diminished solubility for silicon of aluminum at lower temperatures.

Silicon in the usual commercial amounts is probably present as a compound of iron and silicon together with some aluminum. The composition of this compound is not known but it solidifies with aluminum and $FeAl_3$ at an invariant point at 610°C.

P. D. Merica, R. G. Waltenberg, and J. R. Freeman, in Bulletin No. 151, July, 1919, pp. 1033-1049.

MECHANICAL PROPERITIES AND RESISTANCE TO CORROSION OF ROLLED LIGHT ALLOYS OF ALUMINUM AND MAGNESIUM WITH COPPER NICKEL, AND MANGANESE.

Light aluminum alloys of several compositions belonging to each of the three ternary series, aluminum-magnesium-copper, aluminum-magnesium-manganese, and aluminum-magnesium-nickel were rolled out into sheets and tested in tension as cold-rolled, after annealing, and after heat-treatment, consisting of quenching from about 500° C. and aging at ordinary temperature.

The tensile properties of the alloys of the aluminum-magnesium-copper series were superior in all conditions to those of the other series. They may be much improved by an appropriate heat treatment. The alloys of the aluminum-magnesium-nickel series are also improved by heat treatment, but not in the same degree as the former series. The alloys of the aluminum-magnesium-manganese series are not improved by heat treatment.

Samples of representative compositions of each series were exposed to corrosion in the salt-spray test, and the appearance of the samples observed after exposure to the action of the salt spray for one and for two months. The alloys of the aluminum-magnesium-manganese series resisted corrosion, in general, better than those of the other series, and this observation agrees with other experience in the corrosion of such alloys. The heat-treated specimens of the aluminum-magnesium-copper series, however, were but little inferior to those of the manganese series in their resistance to corrosion; the annealed and the cold-rolled samples of that series were the least resistant to corrosion of any of the alloys tested. Hard-rolled commercial aluminum corroded much more than any of the alloys. Annealed aluminum was more resistant to corrosion than the hard-rolled aluminum, but did not compare favorably with most of the alloys.—P. D. Merica, R. G. Waltenberg, and A. N. Finn, in Bulletin No. 151 American Institute Min. and Met. Engineers, July, 1919, pp. 1051-1062.

THE MICROGRAPHY OF ALUMINIUM AND ITS ALLOYS.

The works comprise the investigation of pure aluminium, copper aluminium alloys; nickel aluminium alloys, magnesium aluminium alloys, and managanese aluminum alloys. One of the objects of the research was to discover the most suitable etching reagent to use to bring out the miscrostructure. D. Hanson and S. L. Archbutt, in Journal Institute of Metals, No. 1, 1919, V. 21, pp. 291-318.

THE EFFECT OF WORK ON METALS AND ALLOYS.

The facts collected and summarized. The results obtained by others are collected and noted. The hypothesis that for every temperature there exists a critical range of deformation at which recrystallization of the amorphous material accruing as a result of cold work is extremely rapid, is discussed.

An extension of the hypothesis is suggested, viz:—That the critical degree of deformation commences at a lower stage of reduction than is the initial thickness of the material undergoing deformation. Owen Wm. Ellis, in Journal Institute of Metals, No. 1, 1919, V. 21, pp. 319-333.

HEAT TREATMENT OF DURALUMIN.

Conclusions are drawn relative to the best conditions for commercial heat-treating practice for this alloy. The temperature of quenching should not be above that of the $CuAl_2$—aluminum eutectic, which is usually about 520°C., but should be as near to this as possible without danger of eutectic melting. The pieces should be held at this temperature from 10 to 20 minutes and quenched preferably in boiling water. The hardening, for most purposes, may best be produced by aging for about five days at 100°C.

A theory of the mechanism of hardening of duralumin during aging after quenching from higher temperatures was developed, which is based on the decreasing solubility of the compound $CuAl_2$ in solid solution in aluminum with decreasing temperatures from 520° to ordinary temperatures. It is believed that the precipitation of excess $CuAl_2$ which is suppressed by quenching, proceeds during aging, the precipitation taking place in very highly dispersed form. The hardening is due to the formation of this highly dispersed precipitate.

According to this theory, the hardening of duralumin during aging or tempering after quenching presents a very close analogy to that of steel, and the evidence in support of the theory is of the same nature and of approximately the same competence as that in support of the prevailing theory of the hardening of steel. P. D. Merica, R. G. Waltenberg and H. Scott, in Bulletin No. 150 American Institute Mining and Metallurgical Engineers, June, 1919, pp. 913-949.

HEAT TREATMENT OF ALUMINUM-ALLOY CASTINGS.

It is shown, in general, that the heat treatment increases both tensile strength and elongation of the aluminum-alloy castings. The amount of increase in tensile strength varies from 0 to 40 per cent and the increase in elongation varies from 0 to 100 per cent in a few isolated instances the tensile strength was slightly lowered by heat treatment but in the same samples the elongation was increased. Also in a few isolated instances the elongation was decreased but in these cases the strength was increased considerably.

Results are given indicating that two heat treatments do not improve the castings much more than a single treatment and four treatments can be applied without harmful results.

A table showing the effect of heat treatment on impact resistance is given, indicating that heat-treated aluminum-alloy cast bars containing 3% Cu., 1% Fe. and 0.5% Mg. have about 30% greater resistance to impact than cast bars of the same alloy without treatment. Zay Jefferies and W. A. Gibson, in Bulletin No. 153, American Institute Mining and Metallurgical Engineers, September, 1919, pp. 2493-2512.

THE HEAT TREATMENT OF BEARING METAL.

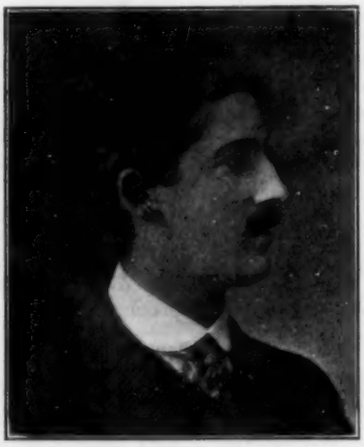
The effects of variations in pouring temperatures. The use of chills and peaning was studied on an alloy composed of tin 86.44% antimony 8.76% and copper 4.4%. In every case the structure showed lack of crystalline uniformity. The authors concluded from their research that the practical question whether a bearing is injured or improved by hammering is left open, although they found it difficult to believe that treatment which shatters the harder crystals can be advantageous. W. Rosenhain & Hilda E. Fry in a paper read at a meeting of British Institute of Metals, at Sheffield, England, September 24-25, 1919.

This article will be concluded in our February Issue.—Ed.

SOFT METAL MELTING BY GAS

An Exposition of the Advantages of Melting and Mixing White Metals Using Gas as a Fuel.

Written for The Metal Industry by Gilbert Colville Shadwell, The Improved Appliance Company, Brooklyn, N. Y.



GILBERT COLVILLE SHADWELL.

If it had been suggested a couple of decades ago that it would be a common thing to find gas used for soft metal melting, the author would have been treated as a dreamer. Yet this is the dream which has come true. To-day, in fact, gas is used for melting stereotype metal by a very large proportion of newspapers, the sizes of the furnaces varying all the way from 1,000 lbs. to 10 tons capacity. Electrotypers find it a preferable fuel for melting the backing-up metal, and industries without number from the one-man factory turning out cast toys to the soft metal manufacturer producing tons a day, are abandoning other fuels.

The reason for this change are not difficult to understand. In the first place, coal has doubled in price in the last few years whereas the cost of gas has either remained stationary or at most has advanced but a relatively small percentage. But this is by no means the chief governing factor, because even when coal sold for half its present price, the users of gas, for the purpose mentioned, were steadily growing. It is necessary therefore, to seek further for the cause, and as will be seen, this is probably dependent upon quite a number of underlying elements.

So, too, the candy manufacturer has put coal among the "has-beens." He finds that his candy makers won't fuss with a coal fire and even if they would, he can't afford to pay them to do it. He hired them to make candy and if he can find a furnace that will start right in without needing to be kindled and watched, and can proceed to cook his batch he will scrap all his old equipment and thereby be the richer after only a very few weeks. Why, in other words, need he spend 8 hours to make 8 batches of candy when, with gas, he can get in about 4 an hour or, say 32 in his 8 hour day?

The same reason besides others applies to the melting of the soft metals. The help is more satisfied. The working conditions are better. The time saved is measurable in hundreds per cent and right here there is one most vitally important point. If your factory overhead is, say, $100 a day, that overhead stays at or about $100 whether you produce sixteen ounces of your product or whether it be sixteen tons, all other things being equal. By this I mean provided you do not have to increase the size of the building or the staff of workers.

To be a little more specific, let us suppose that John Smith, Inc., are making lacquer and that they employ coke as the fuel. They need, say, an hour to finish a batch and the coke costs 50c. Now assuming that gas can be consumed at such a rate that the number of heat units evolved will be as high as can economically be transferred into the varnish then although the cost per hour will be higher, yet the quantity of varnish produced will be increased. The actual figures in this case will hardly be of interest to readers of this publication, but it may be stated that gas has been found (when burned in well designed burners) to take just about one-third of the time of the coke. That means that although the gas probably costs $1.50 per hour against 50c an hour for the coke (these being arbitrary figures only) yet three batches could be produced with the gas instead of only one with coke. Hence the fuel cost per unit of product remains about the same; but in view of the fact that the operators are paid by the hour the overhead for the day is the same as with coke although the output is trebled. This alone brings down the net cost per gallon of lacquer very considerably, and what is true of lacquer is true, in this respect, of soft metals and their products.

Speed, therefore, is one of the chief actors of importance attainable when using gas, and provided there are burners (which there are) to stand up under a continual gas consumption equivalent to several times the maximum consumption of coal in any given space, then gas can, for many operations, oust the solid fuels, owing to the time saved alone even if the price, heat unit for heat unit is considerably above that of coal or coke.

The writer will have more to say regarding comparative costs later. For the present it may be desirable to tabulate or list the advantages of the gaseous fuels:

1. Speed.
2. Cleanliness.
3. No storage space required.
4. It is paid for after using, not weeks or months before as in the case of coal, etc.
5. Less help is needed for the same output.
6. Overhead remains about the same for an increased production.
7. The efficiency of a gas-burning appliance can be made far greater than one burning coal, etc.
8. Time formerly occupied in carrying ashes can be used for something else—no concern leaves its men idle.
9. There is no dust from gas to help injure valuable machinery to say nothing of spoiling the product.
10. The heat is easily controlled even with no automatic device.
11. Gas is turned on when desired, off when the men quit. At best an hour for warming up a big pot is enough to avoid damaging it.
12. Gas improves the working conditions. The help will be more satisfied, and the aggregate cost per unit finished product will be less.
13. The cost of burner head repairs (if a good burner is used) will be less than grate bar renewals.
14. Floor space can be saved with gas furnaces.

Many more features could be added but it is believed that the above are sufficient to show that gas properly installed is the best fuel for the purposes under consideration.

Now for the equipment commonly used in this work with gas as a fuel.

Generally speaking there are two main classes of furnaces. Firstly there are those which are constructed for the purpose of burning gas solely and which have been scientifically designed in order to obtain the very highest efficiency consistent with simplicity; the other furnaces are those which have been converted over to the use of

gas but which are either adaptations of the coal, coke or oil-burning types. The latter may have either had steps taken in their reconstruction to make the furnaces themselves more efficient or else they may simply have had burners inserted in them if for various reasons this step is desirable.

For convenience we shall deal with the types of furnaces built especially for gas first of all. The following tails of the usual gas fired furnaces on the market to-day:

	Nominal Capacity, Pounds	Dimensions, Inches: Height	Pot: Diameter	Pot: Depth	Gas Connection	Air Connection	Cons. Cu. Ft. Per Hour	Blower Required*	Shipping Weight, Lbs.
A	100	15	9	6	¼	...	40	...	50
A	250	29	13½	8	¾	...	75	...	160
F	250	29	13½	8	½	1	100	820	160
P	250	29	13½	8	½	½	125	846	160
A	1,000	31	20	13	1	...	150	...	390
F	1,000	31	20	13	1	2	200	821	390
P	1,000	31	20	13	¾	1	250	847	390
A	2,500	33	26	16	1¼	...	275	...	610
F	2,500	33	26	16	¾	1½	325	821	610
P	2,500	33	26	16	¾	¾	375	847	610

NOTE.—A, atmospheric; F, fan blast; P, positive pressure blast.
*Details of the blowers for the blast types will be referred to later.

Fig. 1 shows an installation of one of the furnaces shown second in the above tabulation—*i. e.*, the 250 lb. atmospheric size.

These furnaces are especially adapted to soft metals including the melting of tin, type metal, babbitt metal, lead, solder scrap, white metal, die casting metal, etc., which

FIG. 1. A 250 POUND FURNACE WITH ATMOSPHERIC BURNER.

may be accomplished with an atmospheric burner, no blast being necessary in such cases as a rule.

Aluminum melting, and cyanide hardening require blast burners. The two intermediate furnaces (250 lbs., and 1,000 lbs.) are the most appropriate sizes for these purposes.

This type of pot is provided with heat-shaped projections which greatly increase their heat absorbing surface and naturally increase the speed and efficiency. A pouring lip is cast on every pot for convenience in pouring the metal. The 100 lb. pot is equipped with lifting bale and tipping handle, all other pots have loops at the top to facilitate handling.

It is, of course, important that the pots be absolutely durable, be made of best iron reasonably thick. If made round (hemispherical), the strain will be kept from acting directly on the bottom and the pot will not have a tendency to crack easily when expansion takes place during heating.

Another important principle of design, is the manner in which the heated gases of combustion are conveyed clear to the top of the pot. This heats the pot evenly all over so that the upper surface of the metal may be brought to the required temperature without over heating the metal at the bottom of the pot. This is a matter of the greatest importance. Moreover the speed of the furnace is increased by having the pot uniformly heated; and the gas consumption is further decreased by virtue of the added heating surface which is available.

The bodies of the 100 lb. and 2,500 lb. furnaces are of heavy sheet steel. The 100 lb. has a peep hole and the 2,500 lb. has cast iron doors to observe the operation of the burners. The 2,500 has shelves to protect the air mixers from falling metal. The 250 lb. and 1,000 lb. furnaces have cast iron bodies. Their shapes conform with the shape of the pots. The outer body of the 2,500 lb. furnace extends clear to the floor, but the flame is not permitted to expand unduly, for an inner lining keeps the products of combustion close to the sides of the pot during the entire journey from the burner to the top ring of the furnace.

A separate section of this article will be devoted to the subject of burner equipment.

The 250 lb., 1,000 lb. and 2,500 lb. furnaces are supplied with burners of either atmospheric (no blast), low blast (for fan lower air at 1 oz. pressure), or positive blast (for air from positive pressure blowers at 1 lb. pressure or more). The 100 lb. furnace is generally made with an atmospheric burner only.

The choice between blast and atmospheric burners depends upon several considerations. As noted above, blast burners must be used where the finishing temperature is high as in the case of melting aluminum, and in cyanide hardening. The temperature in these cases is approximately a low red heat.

However, where an air blast is not necessitated by the temperature required, the choice of burner depends mainly upon the degree of rapidity with which it is desired to melt the metal.

A positive pressure blast is recommended for those cases where air at 1 lb. pressure or more is already installed, or where other conditions call for it. The fan blast, however, is the most desirable form of blast to use.

OPERATION DATA

It must be remembered that there is a difference between the various classes of soft metal which will make some variation in the time required to melt them down. The following data is given to show how approximate figures may be determined and what gain in speed may be expected from blast burners. These figures of course do not apply to aluminum.

The pot of a 1,000 lb. furnace will contain, when full between 350 and 400 lbs. of ordinary linotype "slugs." This charge can be melted and the operation of pouring begun in less than 30 minutes after lighting the furnace, with an atmospheric burner.

Such a furnace will melt from 5 to 6 pounds of metal per cubic foot of gas burned (with an atmospheric

burner), therefore 100 cubic feet of gas will melt from 500 to 600 pounds of metal.

If the burner has a capacity of 150 cubic feet of gas per hour, 500 pounds of metal can be melted in 35 to 40 minutes.

One thousand pounds of metal can be kept melted with approximately 45 cubic feet of gas per hour with this type of burner, but, of course, the amount varies according to the composition of the metal and the kind of gas used.

If the furnace is equipped with an economical fan blast burner, with a capacity of 200 cubic feet per hour (See 1,000 lb. furnace type F), the same amount of metal (500 pounds) may be melted in from 20 to 25 minutes. By burning gas at a higher rate the metal may be melted even faster.

An atmospheric burner is ample in most cases, and it is to be preferred, wherever it can be used, on account of its simplicity.

Although the standard types of furnaces are most in demand, yet it occasionally happens that special equipment is needed to meet the demands of particular cases. Such a special arrangement is clearly seen in Fig. 2. This is an adaptation of the regular furnaces made to form a work table in pairs for railroad shop babbitting purposes.

The fact that blast was necessary is seen from the gas line entering the air as an offset. In this case as there was plenty of air under pressure already available it made the substitution of blast in place of atmospheric burners a relatively simple matter.

In Fig. 2 only one "control" or burner section is provided; in large furnaces there are two as there are 2,500 lb. furnaces, and incidentally the pots are provided with bottom outlets for the purpose of drawing the metal off from the bottom in place of ladling it out. This is a feature that is often desirable when the necessity arises for handling the metal in this way for speed, conveniences or other reasons. Moreover, by the adoption of certain principles, the metal can be prevented from freezing or burning in the outlet if proper thought and care be given to the matter of the burner design and installation.

ALLOYS

A gas-fired soft metal furnace can be used to good advantage for melting any of the soft metals or their alloys where the temperature required is not over 1,000° F to 1,200° F and although higher temperatures may readily be reached, yet a special construction is generally necessary in such cases.

An alloy is usually spoken of as a combination of two or more metals, yet it probably would be more exact to consider it is a mixture—the true combination being an eutectic. When copper is a part of the alloy or eutectic it is generally melted separately in a crucible furnace and added to the lower melting metals such as zinc, tin, lead, etc., after they have been melted in the soft metal furnace. Nevertheless, it is quite common practice to melt the zinc, tin, etc., and then to add small quantities of copper in small pieces as they will then dissolve especially if specifically with various alloys and of their treatment the alloy is then agitated.

In a later section of this article we shall deal more specifically with various alloys and of their treatment when melted by gas. At this point, however, some of the more general features may be mentioned.

There are so many other soft metal melting operations that it would be difficult to deal with all of them, but a general outline will be given of the more important operations involved so as to give an idea of what work can and cannot be carried out.

Among the more important soft metals are the general class of babbitt metals. These embrace alloys of copper, tin and zinc with the addition of lead and antimony in some cases. The babbitt metals (named after Babbitt, the inventor) are used largely for the bearings of engines and machinery generally. Some idea of their variety will be seen in the following table.

	Proportions of					
	Copper	Zinc	Bismuth	Tin	Antimony	Lead
Bearings for locomotives..	2	.....	..	90	8	..
Bearings for locomotives..	8	.....	..	75	17	..
Bearing metal (universal)	2.5	.....	1	....	16.5	80
Lining metal	...	.....	..	42	12	46
Navy babbitt alloy.....	8	.....	..	83	9	..
Commercial babbitt	1.8	33.35	..	64.7	....	1

There are scores of similar babbitts but the above will serve as an example of their diversity. All of such work may readily be carried out in a soft metal furnace.

Originally, the inventor Isaac Babbitt, considered Babbitt metal as being of a fixed composition, namely 90 per cent. tin and 10 per cent. antimony and copper, but now almost any bearing metal is called a Babbitt.

Babbitts should not be confused with bronzes, however, as although soft metals having a melting point of 600°-900° F. can be melted in a soft metal furnace, some bronzes cannot readily be handled in a soft metal furnace.

FIG. 2. SMALL FURNACE SET UP IN PAIRS FOR BABBITTING.

Such bronzes are those having a preponderance of copper such as the following:—

	Proportions of				
Description	Copper	Zinc	Tin	Antimony	Lead
Metal for frictional parts of locomotives (extremely hard)	87	5	8	..	....
Bearings of carriages.....	97	3	..	..	....
Bearings of driving wheels; also for steam engine whistles giving a clear sound	80	2	18	..	....
Steam engine whistles giving a deep sound	81	2	17	..	....
Cross heads of connecting rods.....	82	2	16	..	....
Bearings of axles and trunnions, etc....	84	2	14	..	....
	85	2	13	..	....
	84	7	9	..	....
	68	4	28	..	....
Axle boxes	88	2	10	..	....
Mathematical instruments	90	2	8	..	....
Machinery bearings, etc.....	67	..	14	..	19
Anti friction metal (Stephenson).....	79	5	8	..	8
Imitation silver	64	..	3	..	....
Pin wire	67	33	0.5	..	0.5
Bearing and valve metal.....	83.25	..	7	..	9*

*Also 0.75 phosphorus.

Such alloys are usually melted in a crucible furnace, but white bronzes (having a smaller proportion of copper than zinc, tin, etc.) are melted in a soft metal furnace. In these cases the zinc, tin, etc., are first melted and the copper added afterwards. The copper is then rapidiy "absorbed" by the other metals.

In addition to the above, soft metal furnaces are used for such purposes as melting saltpetre for coloring steel, the steel being dipped in the bath for blueing it.

This article will be continued in one of our subsequent issues.—Ed.

THE STORY OF THE KNIFE AND FORK

THE DEVELOPMENT OF OUR TABLE UTENSILS, TOLD IN TWO PARTS. PART I. THE KNIFE.

WRITTEN FOR THE METAL INDUSTRY BY A. F. SAUNDERS, DESIGNER, THE BENEDICT MANUFACTURING COMPANY, EAST SYRACUSE, N. Y.

Knives and Forks are of comparatively late introduction as table utensils. Although they are known to have been used at a very early period for the carving of food, they did not attain the rank of a recognized dinner set until the art of eating had reached a certain degree of refinement.

A. F. SAUNDERS.

The first rude knives were chipped out of flint or stone after the style of Fig. 1, Plate 1. We also have evidence of other materials having been used such as the bones of animals or pieces of tough wood sharpened to a cutting edge. Along the sea coast the people used knives formed of sharp pieces of shell; knives of wood are still used in some parts of the world. The writer has a very serviceable knife and fork set made of bamboo. This set formed a part of a Japanese Boy Scout kit. It has the advantage of never rusting and floats on the water. For ages the knife served a three-fold purpose, i. e., as a weapon on the field of battle, in the chase, and at the meal. In time it assumed different shapes, according to the particular use to which it was to be put. A dagger shaped served as a weapon, a straight blade for domestic purposes, and a curved shape for whittling. As time passed and the stone age merged into the historic period, man advanced more rapidly because he had the experience of his ancestors to build on, though the relics handed down to us are always expressive of the tastes and character of the people who fashioned them.

A knife may be rude in workmanship yet efficient and serviceable; another may be both practical in form and beautiful in design, while a third may be delicately carved, even encrusted with jewels, yet of little use other than for mere show, betraying the poor judgment of the race that admired it.

Early in history, men were using knives of copper. Somewhat later tin was added to the copper, and the knife of bronze was the next step. Bronze continued in favor until about the time of Caesar, although iron had come into use centuries before. The steel of Damas-

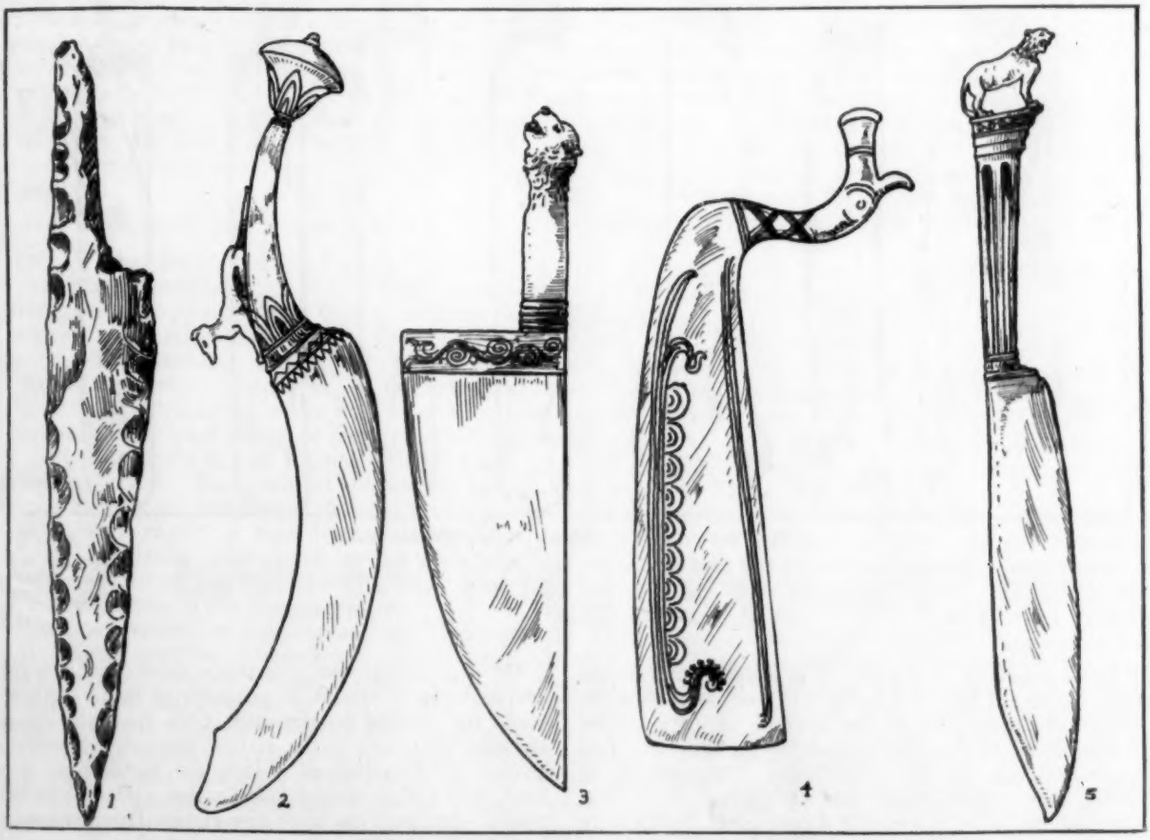


PLATE 1. KNIFE FORMS OF ANCIENT TIMES.

1. Flint knife. Stone age.
2. Bronze knife. Egyptian.
3. Bronze sacrificial knife. Grecian. Archaean period.
4. Bronze sacrificial knife. Scandinavian.
5. Bronze and silver knife. Byzantine. First type of table knife.

cus gradually took their places. But such knives were in no sense table knives as we use them today, for up to the beginning of the Christian era the knife was a carver only. As an article of table use it was scarcely known. Dining tables were unknown previous to the later Roman period as it was the custom for those dining to recline on couches with a small low table placed before each couch. There were no tablecloths or napkins, no knives or forks; the food was conveyed to the mouth by means of the fingers. Often gloves were worn to enable the handling of hot foods; even metallic finger guards are known to have been used. Liquids were, of course, eaten with a spoon. The diners from time to time wiped their fingers upon bits of bread, throwing the fragments on the floor. At the close of the meal trained slaves removed the tables, brushed up the dough, bones and other remnants from the floor, then passed around basins of perfumed water for hand washing. This custom is still retained in our use of the present day to bring his own knife and fork set, which consisted at first of only one or two knives, later on of several knives, a fork and often a puncher. This set was carried in a case or sheath hanging from the girdle. Such knife sets are still in fashion among the peasantry of interior Europe.

The blades of practically all knives made during the last century are of steel. Here improvements have been steadily going on until we now have blades of non-rusting steel. This feature in itself is a wonderful advance. The hollow handle construction used in all patterns of sterling and the highest grades of plated ware have been made possible through the development of the process of die stamping. Each handle is composed of two stampings (exact duplicates) fitted perfectly and soldered together, the steel shank of the blade is then inserted and fastened in place. The manufacture of flat ware is, however, another story which may be taken up in another article.

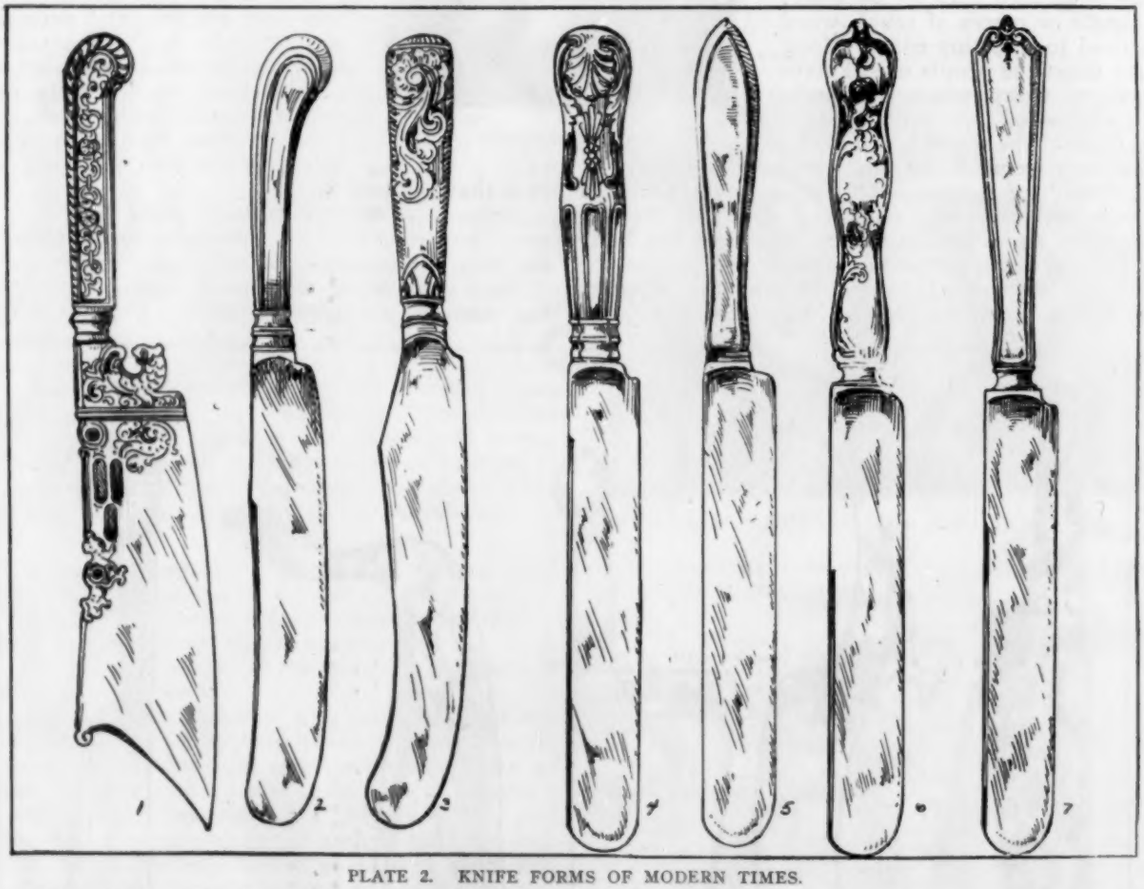


PLATE 2. KNIFE FORMS OF MODERN TIMES.

1. Iron carving knife. French. 15th century.
2. Iron blade, silver handle, table knife. English, late 17th century.
3. Steel blade, silver handle, table knife. English, early 18th century.
4. Steel blade, silver handle, table knife. English, middle 18th century.
5. Steel blade, silver handle, table kife. American, early 19th century.
6. Steel blade, silver handle, table knife. American, 1900.
7. Steel blade, silver handle, table knife. American, 1919.

finger bowl, which is now more of a fashion than a real necessity as we no longer handle our food with fingers. Not until the latter part of the Second Century do we find any evidence of the knife becoming an article of real table use. Some of the illuminated manuscripts of mediaeval days depict dinner scenes. They show that although spoons were in general use at table, forks were unknown, and it does not appear that every one at the table was furnished with a knife. The custom at that period and for some centuries later was for each guest

During the fifteenth century three distinct styles of knives were used. A large carving knife with a broad blade for cutting up the meat (No. 1, Plate 2), a small sharply pointed knife, much like our modern fruit knives, used in lieu of a fork for picking up pieces of food, and a thin bladed knife called a Parepain, or bread peeler, designed to trim the crusts from flat pieces of bread, which were often used as plates.

The next paper will complete the story of the Knife and deal with the development of the Fork.

REVIEW OF THE SILVER SITUATION FOR 1919—OUTLOOK FOR 1920*

By PARKER D. HANDY
PRESIDENT, HANDY & HARMAN, NEW YORK

Reconstruction is the order of the times. Much has been accomplished in the thirteen months since the Armistice was signed. General economic conditions throughout the world, however, are still unsettled; a universal inflation of credit prevails. In a word, this is the world situation of today; ruin, waste and high prices—the legacy of war handed down to the present era demanding peace and restoration of normal conditions for the sake of life, liberty and the pursuit of happiness.

It is not our province to discuss the various difficult problems of after-war finance and exchange, the settlement of international credits and trade balances, the means of paying or reducing the amazing war debts which now confront the world. Bearing more or less on such problems, however, is the commodity of silver, which is to to engage our attention in this article.

PARKER D. HANDY.

The commandeering of the surplus stock of this metal (the reserve supply of standard silver dollars in the United States Treasury) and the regulating of the distribution of a large part of the world's production in 1918, proved silver to be an important factor among the many material resources employed in winning the war. That the production, distribution, consumption and price of silver will continue to influence the processes of reconstruction in many parts of the globe is not to be doubted.

CREDIT INFLATION AND PAPER MONEY

In the present world-wide state of credit inflation, the strain in certain countries is of course more severe than in others; but taken as a whole, the large issuance of paper money in Europe has resulted in a general distrust among the working classes for promissory forms of paper currency. Lack of confidence has brought about the hoarding of coins and in conjunction with the prevailing high prices of silver, the actual melting of coin into bullion and its withdrawal from circulation has occurred. This state of affairs has been acute not only in Europe, but also in Asiatic countries. Evidence of this character is seen in the distrust of the rupee notes in India; the same feeling is being shown by the natives of the interior of China, Manchuria and Siberia toward the Russian ruble.

As a natural outgrowth of the war and the present inflation of paper credits, commodity prices have reached high levels. When the exchanges of Great Britain, France and Italy were unpegged, the first step toward financial recovery was taken, and exchange rates again sought levels in accordance with the laws of supply and demand. The result of this general movement, placing European rates at a discount, automatically tends to curtail the imports and increase the exports of impoverished countries, and thus improve their unfavorable trade balances. The process, however, is bound to be slow, and shortage of raw material and labor troubles have greatly retarded manufacturing the finished goods so badly needed. Enormous adverse trade balances still exist, and in making direct settlements, the present high commodity prices require correspondingly larger shipments of gold or silver to facilitate adjustments.

RANGE OF PRICES

For the first four months of 1919, the silver market, stabilized by Government regulation of prices and strict control over exports of the metal presented but little opportunity for competitive purchases among possible buyers. On May 6th, however, the sudden removal by the Federal Reserve Board of all war time restrictions on silver, and similar action taken three days later by the Government of Great Britain, resulted in very active bidding from all quarters, domestic and foreign.

With a free and open silver market again established, wide fluctuations in price, due as much to the first excitement of being de-controlled as to underlying economic causes, immediately occurred. After a sensational five day advance from the pegged New York Official quotation of $1.01⅛ on May 6th to $1.19¾ per ounce on May 12th, the market dropped suddenly to around $1.11. A further decline took the price below $1.05, but from then on, the market steadied itself and averaged slightly over $1.07 for the remainder of the month.

The quotations for June and July averaged $1.1043 and $1.0639 respectively, while the monthly average for August increased to $1.1137. On September 26th, the price came within a quarter of a cent of the previous high mark of May 12th ($1.19¾); this figure was exceeded a cent or more during the last five days of October, and between November 1st and 25th the price advanced from $1.21⅜ almost without interruption to $1.37½—a price more than 8 cents over the coinage parity figure of $1.2929.

The crossing of the coinage parity in this country was an event of national interest, for the American silver dollar has not been intrinsically worth more as bullion than as coin since 1874. On the 25th of November when bar silver in New York reached $1.37½, the London price was 76 pence. However, on December 16th the London quotation, influenced by the rapid decline of sterling exchange, advanced to 79⅛ pence—the record for all time in that country, and a figure which with exchange at normal, would give an approximate price in New York of $1.73.

During December silver maintained a high level, fluctuating between $1.29½ and $1.34. Briefly, this covers the range of prices during the past year—a year that is needed destined to be a memorable one in the annals of the silver market.

The yearly averages of the London and New York

*Abstracted from the booklet "Review of the Silver Situation for 1919," issued by Handy & Harman, New York.

official prices for bar silver, and the highest and lowest quotations of 1918 and 1919 per ounce, have been as follows:

	New York Official		London	
	1919	1918	1919	1918
Highest Quotation	$1.37½	$1.01⅛	79⅛d	49½d
Lowest Quotation	1.01⅛	.85⅛	47¾d	42½d
Yearly Price Range	36⅜	.16	31⅜d	7d
Average for Year	1.11⅛	.96¾	57d	47 9/16d

CAUSES OF THE RISE IN BULLION VALUES

To understand the reasons for the rapid rise of the price of silver during the past eight months, it is necessary to recall some of the conditions which existed in the market prior to the removal of Government restrictions last May.

In addition to the 200,000,000 ounces of bullion shipped to India as a result of the operation of the Pittman Act of April, 1918, large additional supplies of mined silver were also sent to that country during the last few months of the war and the first six months after the signing of the Armistice.

The shipments of these additional supplies of silver mined in this continent were the direct outcome of an agreement between the governments of Great Britain and the United States, resulting in the adoption of war time restrictions on export licenses for silver bullion in this country in August, 1918, and followed shortly by similar Government action in Canada.

The supplying of India with the vast quantities of silver needed to maintain her currency system and to reduce the unfavorable balance of trade against Europe and America, which she had accumulated during the previous war years, averted serious trouble in that country and by so doing materially aided the cause of the Allies and the United States. At the same time, however, it prevented the normal flow of silver to China and the Far East. A large amount of orders for mintage and the arts was thus accumulated, and it was to be expected, therefore, that with all government restrictions on price and export removed, there would also be a very insistent demand for the white metal from China and other quarters.

THE DEMAND FROM CHINA

This soon proved to be the case and orders for China alone came into the market for millions of ounces during the next few months. The immediate demand for silver being greatly in excess of the supply, caused the price to rise to record heights. Periodical slackenings of the buying from the Orient resulted in intermittent recessions of price. These declines, however, proved only temporary, and an unprecedented demand from China continued.

The necessity of replacing the silver sold to India during recent years is one of the main causes for the China demand. Another important point is the excess of China's exports over imports. Additional factors are the unsettled political conditions of the Republic and the general distrust throughout the Orient of all forms of paper money resulting in a movement to replace them with metal. While there may be other reasons for this demand, the cumulative effect of those cited will go far towards explaining why the East has continued to buy so persistently throughout the last eight months.

PRODUCTION STATISTICS

From present indications, however, it seems probable that this year's supply of silver produced from mining and smelting operations throughout the world will be about seven million less than of 1918, which, according to the report of the Director of the Mint, totaled about 197,000,000 ounces.

One circumstance tending to decrease our production of silver was that, with the ending of the war, the slump in the price of copper resulted in copper refiners curtailing their production (by as much as 50% in some cases), with a consequent decline in the large percentage of silver produced as a by-product of copper. Taking this into consideration, it is not reasonable to estimate the production of this country—despite the high prices of silver—at more than 55,000,000 ounces, about twelve millions less than that of 1918. Canada's yield, on account of labor troubles in Cobalt, will also be below that of last year and is estimated at only 14,000,000 ounces. Silver mined in Mexico, according to Government reports, amounted to 35,000,000 ounces in 1917 and 62,000,000 in 1918. This country's imports of refined and unrefined silver from Mexico, as a result of that nation's increased production, can reasonably be placed at 72,000,000 ounces.

Our estimate of the world's production of silver during the calendar year of 1919 is as follows:

	Ounces
United States	55,000,000
Mexico	75,000,000
Canada	14,000,000
South America, Central America and West Indies	19,000,000
Europe	7,000,000
Australia	10,000,000
Asia and Africa	10,000,000
	190,000,000

Below is given an estimate of the distribution of this amount during the past year. To paraphrase the usual formula—while this information is not guaranteed, it has been compiled from reliable sources and we believe it substantially correct:

	Ounces
Home consumption in the Arts	25,000,000
United States Government purchases	4,000,000
Mexican Government purchases	3,000,000
England and Continental requirements	25,000,000
Shipments to India	39,000,000
Shipments to China and the Far East	65,000,000
Origin from various sources, destination unknown	29,000,000
	190,000,000

Exports of fine silver bullion from the principal shipping ports of North America during the past twelve months have been approximately as follows:

	Ounces
New York to England and the Continent	20,700,000
New York to India	13,900,000
San Francisco to India	23,000,000
San Francisco to China and Far East	57,800,000
Halifax to England	5,200,000
Vancouver to China and Far East	2,700,00
	123,300,000

Between January and May 76,000,000 fine ounces obtained from the melting standard silver dollars under the Pittman Act were also shipped to India for the account of the British Government.

DOMESTIC SITUATION

Before discussing the future of the silver market,

the domestic situation deserves attention. While the amount of new white metal that went into the Arts in 1918 was only fifteen or sixteen million ounces—a figure somewhat below the maximum allowed by the War Industries Board—the trade began to show marked signs of improvement before the removal of federal limitations on industrial use. With this action a reality, and the shadow of Government restraint no longer in evidence, the domestic demand for silver grew at a rapid pace, and the past year has witnessed the consumption of about 25,000,000 ounces of new silver in the arts.

A WORLD-WIDE DEMAND FOR SILVER

The world's output for the past year, although augmented by 76,000,000 fine ounces obtained from melted U. S. silver dollars, has by no means satisfied the demand. Present high prices testify to that. In fact it is generally conceded my those who have given careful attention to the matter, that there exists a world shortage in silver.

That the world demand during the next twelve months will continue to be heavy, appears in most quarters to be a foregone conclusion. In support of this opinion, the following economic conditions are cited:

During the war, and for many months after the start of demobilization, the Allies and the United States purchased amazing amounts of raw materials in the Far East. Reconstruction in Europe has not yet progressed far enough to decrease materially these adverse trade balances by the shipment of commodities. Nor is a settlement through bank credits and bond issues sufficient because of a lack of proper banking organization and credit machinery in these newly developing sections of the Orient. Therefore, the only alternative is a settlement by means of the precious metals; but as the United States and the British Empire, the chief holders of the world's gold supply, will most assuredly continue to maintain their positions as creditor nations and conserve their reserves of the yellow metal, the shipments of silver in volume to the Far East will represent a large share of the precious metal export. Furthermore, the vast Republic of China needs silver for her domestic as well as her foreign trade, and it must also be remembered that China's power of absorption of silver is enhanced because of the fact that, like the Hindus, the Chinese continue to look upon this metal as value itself and not merely as a medium of exchange.

Other sections of the globe will need more silver during the coming year than in recent times —European countries, for example, and particularly the Central Powers, have so freely issued paper money which must sooner or later have a metallic basis for redemption—in all probability a silver one. The replenishment of white metal in the arts which various countries at war have melted down for coinage purposes, will likewise add to the general demand.

Silver is also coming into greater prominence as the circulating medium of East and West Africa and Egypt. The lands now liberated from Turkish rule, and under European guidance, (Mesopotamia, Palestine and Arabia) all need silver. The Scandinavian countries are also interested in the white metal, both for coinage and for the arts. Russia and Siberia will both require more silver in circulation before their credit, which revolutions have weakened or destroyed, can be re-established.

From the above it is fair to draw the conclusion that a general demand for silver can be expected to spring up from all parts of the world. In forecasting future prices from present all-around indications, therefore, there seems to be sufficient justification for assuming that next season's inquiries will prove sufficiently liberal to maintain silver prices at a level but little, if any, below the range of the last few months. It will be interesting to note the effect on silver of the opening of the Chinese new year the latter part of February, when the import season sets in. Whether or not quotations will continue to touch the high spots of our recent market, still depends on what such purchasing centers as Shanghai and Hongkong are willing to bid. The student of finance who can prophesy the China demand for the coming year will be able to foretell the future trend of silver bullion values.

GOLD SWORD FOR PERSHING

MISSOURI'S GIFT TO HER FAVORITE SON.
WRITTEN FOR THE METAL INDUSTRY BY H. E. ZIMMERMAN.

The people of the State of Missouri, upon being advised that Congress had failed to honor General Pershing by presenting him with a sword, immediately decided to present him with one of gold. The movement was begun and brought to a successful issue by the Kansas City *Post*, the sum raised having been solicited only by popular subscription. The order for the sword was placed with Cady & Olmstead, jewelers of Kansas City.

GENERAL PERSHING'S GOLD SWORD.

The scabbard is of 18-karat green gold, engrossed with laurel wreaths, signifying victory and clemency, and encircled with bands of yellow 18-karat gold, on which is inscribed General Pershing's complete military record. Pershing's four stars, denoting his rank of General, are wrought upon the wreath of laurel in platinum, and encrusted with blue white diamonds. The Great Seal of Missouri, in several colors of gold, representing the friendship of those who contributed to the sword, is laid upon the scabbard. The jeweled hilt is of 18-karat gold, hand-chased, engraved, and studded with diamonds, rare rubies, and multicolored sapphires. In the hilt base is set a large blue sapphire, Pershing's birthstone. On both sides of the end of the scabbard, the American eagle is raised in yellow gold, representing the ever watchful guardian of American liberty. Engraved on one side of the handle are the famous words spoken at the tomb of Lafayette: "Lafayette, we are here." On the reverse are Pershing's service stripes.

Pershing's brother, and artists who have examined this sword pronounce it to be beautiful beyond description! This sword is to be painted in the wonderful world war picture, "Phantan de la Guerre," at Paris, France. It is the finest sword ever presented to a military commander and cost about $7,000.

THE EARLY HISTORY OF ELECTRO-SILVER PLATING

How the Art of Electroplating Began in England,

By R. E. Leader, B.A. (Sheffield).

The varied and extensive use made of electro-plated articles in domestic life would alone merit some attention to the early history of the development of the process of silver-plating.* Prior to the introduction we had to rely almost entirely on similar utensils made either of silver or pewter, supplemented to some extent in the period immediately before the discovery of plating by Sheffield plate, and on spoons, forks, etc., of steel, close-plated with silver, or of the newly-introduced "nickel-silver," a rediscovery of an ancient alloy said to have been known to the Chinese.

Apart, however, from its utilitarian interest, the history of electro-plate emphasizes a period of very active experimenting.

Referring to the allied art of copper electrotyping discovered about the same time (1838), apparently independently, by Thomas Spencer, of Liverpool, and Jacobi, in Russia, Alfred Smee writes in 1842, in the Preface to his "Elements of Electro-Metallurgy" (2nd Edition): ". . . There is not a town in England that I have happened to visit, and scarcely a street of this metropolis, where prepared plasters are not exposed to view for the purpose of alluring persons to follow the delightful recreation afforded by the practice of electro-metallurgy."

It is not within the scope of this paper to trace the earlier history of electro-chemistry. Suffice it to mention that in 1833-4 Faraday propounded his laws of electrolysis, and in 1836 J. F. Daniell, Professor of Chemistry in King's College, London, described the first constant current battery.

Starting from this period, one can trace that branch of the subject which had for its definite object the development of processes of manufacturing scope and value.

Nowhere was this inception more sedulously pursued than in Birmingham, where gilding by older methods had long been practised. There the Elkingtons and others, aided by skillful metallurgical chemists like Ogle Barratt and Alexander Parkes, and by clever operators such as the Millwards and Thomas Fearn, were striving to exploit in the larger atmosphere of the workshop the fascinating results of experiments. By employing methods set out in a series of patent specifications (1836 to 1838), the cousins George Richards and Henry Elkington had made such advance in gilding as to crush competitors adhering to older processes out of the field.

Another patent due to Barratt (1838), but taken out jointly by him and Elkington, claimed that they had invented certain improvements in coating and coloring metals never before practised, of which they were the first and true authors. Up to this time and, as will be seen, even later, the pioneers concentrated themselves chiefly on the solutions employed, laying little stress on electrical action. Mr. B. Woodcroft, in his official "Abridgement of Patents," has pointed out that "Although no mention is made of electricity in the above specification, the immersion of the metal in a solution of zinc, in contact with zinc of amalgam of zinc, forms a galvanic circuit, and thus employs electric force."

At this stage Mr. George Elkington, engaged on the problem of silver-plating, was sufficiently encouraged to form a business agency of an intimate kind with Mr. Benjamin Smith, of London. A correspondence between August, 1839, and June, 1840, shows many difficulties encountered, and strenuous efforts to surmount them.

Smith sends a gilt candelabrum as a pattern of one to be made and silvered; also four candlesticks are ready for plating; and he is told that although there is uncertainty how soon the improvement can be effected, coming success with a new system, different from any hitherto used, is positively anticipated. The coating of silver might, it was explained, be varied, and could be deposited thick enough to be chased. But things did not run smoothly, and by June, 1840, it had to be confessed that the result was disappointing. It is fairly clear that the new system now referred to was a process devised by Ogle Barratt, assigned to the Elkingtons, and covered by letters patent applied for on March 25, 1840, "For improvements in coating, covering, or plating certain metals." The six months allowed before lodging the specification were full of anxiety, and when that time had nearly expired, Mr. Elkington was in London, in consultation as to the final form of the claim. Then it was found that another discoverer was in the field.

SILVER CYANIDE SOLUTION

This man was John Wright, a young Birmingham surgeon. Many fables have been woven respecting his origin. He was the scion of a substantial family long settled in the district where Yorkshire, Derbyshire and Nottinghamshire meet, but his father having removed to Kent, he was born on the Isle of Sheppey. His school was at Brampton, near Doncaster: his apprenticeship was served with a surgeon at Rotherham, and after a course of study at several medical schools, he established himself in practice in the Bordesley district of Birmingham in 1833, being then twenty-three years of age. There he patiently pursued the experiments in metallurgical chemistry to which he had long been devoted, and on one happy day, acting, it is believed, on a hint obtained from the writings of Scheele, found in cyanide of potassium the solution of the problem of satisfactory silver deposition. A gilded chain and a silvered plate were the first tangible evidences of his success. But the mere exhibition of these was not enough; the thing had been done, but silversmiths in Birmingham and Sheffield lacked faith enough to give financial assistance without knowing how it had been accomplished. This Wright resolutely declined to disclose, and in the end went up to London to take out letters patent on his own account.

There is no trace that he had applied to the Elkingtons, which is curious, since theirs might seem to have been the most obvious market. But here what looks like pure luck stepped in and took control. For George Elkington put up at the London hotel which Wright had chosen, and one patent agent was acting for both. Thus they met, and finding themselves in the same boat, commonsense required that they should pull together. By the agreement eventually signed, completion of the contract was made dependent on a series of trials and proofs. Not until these were carried out were the Elkingtons to know the precise nature of the mystery they were buying.

The trials satisfactorily established the value of Wright's process and vindicted his representations, but as the same principle was deemed to underlie both his methods and Elkington's, the variation being only in the solutions, it was decided to embody Wright's amendments in Elkington's specification. This subsequently proved to be a serious embarrassment and anxiety, for competent authorities advised that the validity of the

*According to the Census of Production, 1911, the total value of the output of the electro-plate trade of this country for that year was £2,235,000, the value of goods made of silver in the same year being £1,930,000.

patent was thereby so jeopardized as to imperil its power to resist any determined assault. The document was hurriedly completed, and was lodged only in the last days of the six months of grace. The patent is dated September 25, 1840, and is numbered 8447. It stands as the master patent, the basis of all success in electro-silver plating. There is no need here to retell its details, but it is necessary to note that in such claims as it made to the use of a galvanic current the single cell arrangement was implied. Its non-mention of Wright's name follows, of course, from what had been said as to his contribution being incorporated in the particulars lodged in support of the letters patent granted to George and Henry Elkington on March 25, 1840.

EARLY DIFFICULTIES

Legal protection having been secured, the patentees were confronted with the greater problem how to press home their advantage by successful manipulation in the workshop, and by a remunerative output of goods of a quality commending themselves to the public. The enthusiasm of the inventors found no reflex in outside opinion. Presages of a revolution in silver-ware were received with chilly incredulity, and the derogatory word "brummagen," as a synonym for shoddiness, was freely used by the cynics. The suspicion that the coating would prove to be only a temporary and unstable veneering was shown to be more than a prejudice when early samples were returned on shopkeepers' hands as defective. Barnards, of London, among the earliest to take out a license, reported that the battle they had to fight for a process in ill-favor with the trade was so hard that they despaired of making headway. The manufacturers of old Sheffield plate laughed scornfully at any idea that their craft was in danger from a bubble that must soon burst. Before long they had to whistle rather loudly to keep up their courage.

Without absolutely accepting Dr. Gore's* assertion that for at least seven years the process was not remunerative, there can be no doubt that success or failure long hung trembling in the balance. Mr. Josiah Mason, speaking of the time, some eighteen months after the start, when he joined the firm, was accustomed to describe the warnings of his friends against the embarkation of his capital in a speculation that could end only in ruin.

The Elkingtons, however, with unabated faith, set about perfecting the process in their own works, and in seeking to induce licensees to take it up. In the latter respect their success was disappointingly slow, and with the exception of an extension of the arrangement with the aforenamed Benjamin Smith, giving him a monopoly of the London trade for certain scheduled articles, and of one or two minor licenses for special details, it was not until 1843 that things began to move. The patentees had naturally made great efforts to enlist the cooperation of the Sheffield silver-platers. There were protracted negotiations with the two leading firms—Roberts and Creswicks—but their only result was a large mass of correspondence, which survives to show, on the one side, a lack of confidence in the future of a highly speculative adventure, and in the validity of the patent; and, on the other, an exaggerated estimate of the value of severely restricted licenses. The Sheffield firms, with their showrooms full of temporarily unsaleable old plate, and with their workshops idle, but abundant reasons for desiring the failure of the new competitor. But the vendors, instead of tempting them against their will and cautious judgment, alienated them further by the severity of their terms. And having thus lost those who would have proved their most valuable allies, they had to place their process in the hands of a class of makers who had nothing to lose but everything to gain by adventuring into an enlarged field. Thus, in Sheffield especially, it was the Britannia-metal smith who, with experience in the manufacture of domestic wares in baser metals, could, without much risk, yet with prospect of a wider outlook, add an electro-plating plant to their factories; and the terms to them were adapted to their individual circumstances in many varied forms.†

EARLY LICENSEES

It was John Harrison, a Britannia-metal smith who, on June 13, 1843, took out the first license in Sheffield, the fourth granted for plating in general. He engaged as operator an out-of-work table-knife forger, George Walker, who, in the course of duties as caretaker at a chemical class, had dabbled in the students' electrical experiments. At Harrison's expense he was sent to Birmingham to be initiated into the plating process. William Carr Hutton, who had established in Sheffield a branch of his father's Birmingham business—"close-plating" on steel and the making of spoons and forks in "improved German silver," otherwise called "British plate"—obtained a license a day after Harrison's.

By the end of two years the latter had paid royalties on articles plated of the net selling value of £5,311, and although Hutton's output was smaller, he reported sufficient improvement and success to encourage working with more confidence. Such was the position of electroplating in Sheffield when George Walker threw up his engagement with Harrison, and took out a license for himself and a partner, Samuel Coulson. In this an abortive attempt was made to prevent Harrison working not only for his own customers, but "on hire" for the trade. Not having works ready, Walker was unable to commence manufacturing until the end of September, two years after Harrison and Hutton had been in the Market.‡ From that time, although the number of Sheffield licenses increased but slowly, the output kept pace with the growing popularity of the wares. And when the old silver firms found themselves compelled to supply electro-plate or to lose customers, they compromised to the extent of obtaining by deputy for sale what they could not, even yet, bring themselves to make.

It has been stated that the first intention of the Elkingtons was to rely rather on the activities of licensees than on their own manufacture for the supply of the market, but the reluctance of trade to take up the work, and the difficulties of establishing some uniform system, indicated by innumerable drafts of alternative plans, soon forced on the pioneers the conviction that they must show their confidence in the mercantile value of their patent by vigorous example and energetic popularizing of the new wares. When this had become evident, they acted with decision. Leaving the original shops to their former uses, great extensions were made for setting up a large and complete electro-plating plant; and a spacious showroom was added as an object lesson to the still incredulous.

---

*George Gore, "On the Relation of Science to Electro-Plate Manufactures," Popular Science Review, 1862, vol. i. p. 327.

†In connection with the licenses, a scheme of marking was elaborated with much care, but it did not stand the test of experience, and was before long abandoned. The patentees began by requiring the articles to be stamped with the letter "E," the initials of the licensee, with the word "patent" and with crosses, single, double, and treble, indicating lowest, middle, and best qualities. For yet a fourth, better than the best, the words "extra patent plate" were to take the place of the laconic "patent," together with three crosses. Yates and Sons, of Birmingham, covenanted to use "Y. & S." with the mark at present adopted by Elkington & Co., viz., "a crown and E. & Co." But a year later this was simplified to "Y. & S." and a crown. Before long, however, the patentees were content with any distinctive mark enabling them to identify the manufacturer.

‡Messrs. Walker & Coulson founded the business now carried on under the title Walker and Hall, and owing to the erroneous supposition that John Wright, the collaborator of Elkington, was connected with Sheffield, it was claimed that this firm were associated with the first successful silver plating.

COMPETING PATENTS

But beyond the problem of setting the industry on the broad road for prosperity there was constant anxiety as to the soundness of its monopoly. Unless the validity of the patent could be upheld, the sanguine anticipations of its holders would be blown to all the winds of heaven; and from the first it was challenged from many quarters, while the smaller fry of infringers were active in piracy. In this respect there was no hesitation or variation in the plan of the defensive campaign. There runs through all the records an ordered regularity of procedure almost monotonous in its repetition. When improvements of manifest value were offered on reasonable terms they were bought outright.

In 1840 Barratt claimed further discoveries, and a long discussion commenced with Elkington, who threatened opposition. Eventually the patent No. 9077 (March 7, 1842) was completed and assigned to Elkington. The claims cover a wide field, but do not appear to be of such importance as their author first stated; so far as silver is concerned, they are limited to the plating of articles by immersion in a boiling solution of sulphide of silver in potash, with or without galvanic current. Barratt obtained yet another patent, No. 9786 (June 15, 1843), for depositing by "an electrical magnet battery." There was the usual opposition and the customary negotiations, but it does not appear clearly whether this became Mr. Elkington's property.

The efficiency of electro-plating was greatly increased by the researches of Dr. H. B. Leeson. These resulted in a natent, No. 9374 (June 1, 1842), for improvements including methods of depositing silver on wax stereotype casts, motion of the articles and agitation of the solutions during deposition, a coating of mercury preparatory to electro-deposition, and claiming some 430 salts or other compounds not before used. The motion of the articles and the preparatory processes of "quicking" or obviating the non-adherence or "peeling" of the deposit are of great practical importance. Leeson's rights were secured at a most opportune moment, because only three days later Edmund Tuck, a London silversmith, lodged claims of protection (No. 9379, June 4, 1842), for a method of remedying this defect.

Tuck got his patent, and boldly invited custom for his "Improved Electric Plating" (June 4, 1842). Though there was much talk of stopping him, no drastic measures were taken, and 1844 arrived without any appeal having been made to the courts. It seems probable that Tuck's success in pushing his process was not very great. We hear of "a man of the name of Tuck" in vain visiting Sheffield with intent to induce the silversmiths there to take up his process.

Such rivalry as there was, however, in Tuck's patent, did not end until the year 1847, when an arrangement was made by which William Cullum, of Cockspur street, into whose hands the patent had fallen, assigned it to a trustee for the Elkingtons.

THE FIRST ELECTRO-PLATING DYNAMO

Of considerable importance was the invention of John Stephen Woolrich (patent No. 9431, August 1, 1842) for electro-plating with a horseshoe magneto-electric machine, and using the double sulphites of silver and other metals with the alkalies as depositing solutions.

Woolrich's opposition was taken very seriously, and counsel's opinions (which covered also Tuck's position) were calculated to give the pioneers some sleepless nights; for they indicated that the validity of Wright's patent hung on a very slender thread. So far as the Elkingtons themselves were concerned, one gets the impression that they were perturbed more by Woolrich's double sulphites and alkalies than by his magnetic apparatus.*

The magneto-electric machine of Woolrich is of great historic interest, for it was undoubtedly the forerunner of the dynamo machines, the earlier applications of which were in their turn so closely associated with electro-deposition. Although it seems probable that the Elkingtons did not use these machines themselves very largely, records show that they not only acquired the right to do so, but that their own assistants experimented and patented certain improvements. In this as in the chemical side of the industry, they were always on the look out for any developments which were available.

It is clear that the proud claim of the magneto machine of Woolrich which stands in Aston Hall, Birmingham, manufactured by Prime and Son, and dated February 22, 1844, to be "the first electro-magnetic machine used for electro-plating" needs qualification, as it has quadri-polar magnets, and was preceded by a uni-polar apparatus, as originally specified in the Woolrich patent.

Mr. Charles Askin, who had already appeared as a supporter of John Wright in his negotiations with the Elkingtons, again figures in the history as a supporter of Woolrich, in his attempt to come to terms with the Elkingtons when he offered them the patent rights for £15,000. Various demonstrations and trials were given, including the construction of a "Leviathan magnet." Eventually, Messrs. Brooke Evans† and J. F. Leedsam purchased the patent for £3,000.

Brooke Evans granted working licenses to several persons, including Woolrich himself, and to Thomas Prime, the maker of the magnetos in Birmingham; also in Sheffield to W. Carr Hutton (April 7, 1845), who already held Elkingtons' license; and to William Briggs, who founded the firm of Roberts and Belk. John Harrison was also approached, but he refused, in loyalty to the Elkingtons. In May, 1845, Brooke Evans assigned his rights to the latter for £100 down and £400 annually during the life of the patent.

George Walker's license was extended to include the right to use Woolrich's process, and from correspondence which ensued, it is evident that its attraction to some of the Sheffield firm was its claim to deposit silver on to a Britannia-metal surface direct. Harrison (whose original permit covered this use) reported that he had done so satisfactorily; Walker despaired of getting any good results, and had to make another visit to Birmingham for instruction.

John Wright died when only thirty-six years of age (May 3, 1844), from paralysis caused by injuries sustained in a gig accident. He had lived to see the assaults upon his discovery, but not long enough to witness its validity established beyond further cavil, or to reap any considerable financial benefit from his ingenuity. His widow, who became the wife of Mr. Charles Cammell, of the great Sheffield steel firm, received £1,000, and enjoyed an annuity of £325 until her death at the age of eighty-two, in April, 1900.

SIEMENS' PATENTS

In 1843, a young German found his way to Birmingham in a somewhat haphazard fashion, the humours of which he was accustomed to describe afterwards when he had become famous as Sir C. W. Siemens. His ingenuous charm of manner so won upon the partners that for once, and once only, they departed from their fixed rule of requiring delivery before payment. Mr. George Elkington afterwards extenuated this lapse from strict

†Brooke Evans and Charles Askin were associated in the firm of Evans & Askin, Nickel Manufacturers, the firm being that now existing under the title Henry Wiggin and Co., Ltd.

business caution by pleading the feeling of confidence Siemens inspired, "and the commiseration we felt for him on account of his detention in England (having ourselves been similarly situated for some months in France)." The result was that the future Sir C. W. Siemens returned to Germany "feeling a comparative Crœsus," since he carried with him £400 and three post-dated bills of like amount; leaving behind a thermo-electrical battery, three untried solutions, and specifications for a patent taken out in the name of Moses Poole, an agent. Before the bills fell due things had gone awry. The solutions had proved unsuccessful. Mr. Fox Talbot pressed a prior claim to the application of sulphate of soda, and this tangle ensued: Talbot could not use his particular solution without terms from Elkingtons, and Siemens could not use his variation (hyposulphate of soda) except by arrangement with Talbot. When things were ultimately adjusted, the Elkingtons had paid £1,600 for what was of small commercial value.

This episode, acknowledged by Sir William Siemens as giving him his first step in practical life, is worth mentioning, because it illustrates time's quick obliteration of the footprints of industrial development. When, after the death of Siemens in 1883, Dr. William Pole undertook to write his biography, application was made to the Elkingtons for particulars of the Siemens transactions. But the original partners had passed away long before, and their successors, unaware that the facts were to be found in their own dusty archives, passed on the inquiry far and wide to surviving employees, patent agents, and others. Dr. Pole did, indeed, after much trouble, discover that the process was hidden under the name of Moses Poole; but beyond that he had to content himself with Siemens' old-age references to his youthful adventure.

BRIGHT PLATING

The discovery of the talisman for bright plating, superseding the dull frost-like appearance resulting from the earlier methods, forms an outstanding advance in silver-plating, and affords a happy relief from the usual complications of rival claims and controversies. Like Thomas Bolsover's quick appreciation of the meaning of a casual fusion of silver and copper, it has sometimes been called an accident, at others, a discovery, but, as in that case, it was really the intelligent deduction of an operator upon whom flashed the possibilities of an unexpected happening. William Millward, one of Elkington's workmen, noticed that metallic articles in a vat, also containing wax moulds treated with a solution of phosphorus in bisulphide of carbon, took on a bright appearance. Following this up, he convinced himself rightly that to the bi-sulphide of carbon was attributable this magic touch. Mr. Elkington gave him £400 for his secret. But Millward's brothers, Richard and Arthur, and Morris Lyons, also an operator, were behind the scenes, and carried their knowledge to another firm of Birmingham platers, the Ratcliffes. The final issue was a joint interest of the two firms in the various patents that resulted; William Millward acting in the Elkingtons' interest, and Arthur Millward in the Ratcliffes': while Lyons, going over to a third maker, Stanhope Baines Smith, involved his employer in a wordy war. The Elkington-Ratcliffe combination, too cumbrous to work well, was ended after two years. One result was that the Ratcliffes set up a factory in Sheffield, installing Arthur Millward as manager, and this competition at their own doors elicited many wails from the licensees here, who found their work "on hire" for other silversmiths seriously invaded. The venture ultimately fell into Arthur Millward's hands, and it still exists under a limited company.

The alloy "nickel-silver," which for so long was called "German silver," despite the fact that British and Scandinavian chemists seem to have played a great part in its rediscovery, was almost from the start employed by the Elkingtons in the manufacture of the articles which they submitted to silver-plating.

The history of this alloy is of considerable interest,* but is outside the scope of this paper. It may be mentioned, however, that its use for the above purpose relies both upon the superior mechanical properties of the alloy and upon its white colour. Already in 1830 Samuel Roberts applied it to "Sheffield plate" by introducing a layer of nickel-silver "between the silver and the copper on which it is usually plated, so that when the silver wears away the defect is not very perceptible, owing to the similarity in colour of the alloy to that of silver."

P. N. Johnson, of Hatton Garden, the founder of the firm of Johnson, Matthey & Co., commenced the refining of nickel in England about 1830, and W. C. Hutton, who obtained the metal from this source, and resold much of his output to Johnson, specialized in the production of spoons, forks, etc., both in "British plate"—the alloy itself—and in "Argentine plate"—the alloy covered with a thin coating of sheet silver.

For the next great advance in the development of electro-plating for domestic articles we are indebted to Alfred Krupp. The electro-plating process, adapted to the silvering of spoons and forks in unlimited numbers, found itself also confronted by the initial difficulty which had hampered large output, at moderate cost, whether in fused plate or by close-plating on nickel-silver. The trouble was the slow and costly manipulation required to shape the raw material of the article preparatory to plating. That overcome, the vats would do the rest by the gross as easily as by the dozen. It was with machinery for rolling and cutting the metal and stamping out "blanks" that Alfred Krupp found his way to Birmingham. He undertook not only to supply machines and to license their use, but to install them. He supervised the erection of new mills for the Elkingtons in Brearly street. The result of his activities, which covered a period from April, 1848, to June, 1851, was that he returned to Essen, not with Siemens' "Crœsus wealth" of £400, but with £8,000 in his pocket, leaving Mr. George Elkington to pen a dithyrambic pæan on the all-embracing reach of that electro-plating which could soar into the highest realms of art, and could garnish the tables of the humblest with forks and spoons of exquisite form.

FRENCH CLAIMS

Beyond the rivalries arising from the ceaseless efforts of English assailants in the period under review there were excursions into foreign markets, accompanied, in the case of France, with perennial conflict. There the exploitation of the Elkington process by Mr. Christofle was vigorously assailed by a chemist, M. de Ruolz, who stoutly claimed priority in electro-gilding and silvering. For ten years or more, war was waged not only in words but in the law courts, and its echoes still rumble through masses of polemical literature and documents. The story is long and complicated, and if it were worth while to tell it in detail, a large volume would be required. Here it is only possible to say that Mr. Elkington lodged a strong caveat against a report by the French jury of the Great Exhibition of 1851 endorsing the De Ruolz claims, and that a thorough investigation by the Paris Academy of Sciences established the English priority. The final

*For description of Woolrich's machine, see W. H. Carbutt. METAL INDUSTRY, vol. vi. pp. 101-104 (1914). Also Journal of the Society of Arts, 1903, vol. li, p. 208.

See A. W. Wills, "Birmingham and the Midland Hardware District," British Association, 1885, published by R. Hardwicke, London, 1866, pp. 671-675. Royal Ontario Nickel Commission, 1917, pp. 337 et seq.

result was a compromise, not arrived at until sums had been expended in litigation which, in the words of Mr. Christofle, brought the business to the verge of bankruptcy.

LATER DEVELOPMENTS

This narrative has now been brought down to the period when the Elkington-Wright patent was nearing its end by effluxion of time, and as the title of this paper is "early history," the writer does not propose to carry it further. Within a decade the new process had confuted all sceptical prognostications. Through the door unlocked by Wright's open sesame, floods of new light had been poured by the efforts of clever chemists and ingenious inventors. A great industry had arisen on the ruins of the old Sheffield fusion process. Sterling silver still held its own among the rich, Britannia and other base metals among the poor, but the large middle area was flooded with electro-plate.

One of the latest attempts of disbelievers to encourage themselves in their incredulity as to the permanence of electro-plate is found at the Great Exhibition of 1851. There the jurors, in a *lucus a non lucendo* report, based hesitation as to electro-plating's future on what was really its most obvious merit. They wished, they said, to guard against being considered as expressing an opinion on the merit of the application of the electro process of silver-plating to objects of domestic use. They desired only to commend the artistic application of this discovery, to which alone they were inclined to think it adapted. At the same time, they thought the application of gold by this process a highly meritorious invention. The explanation of this curious judgment is probably to be found in the fact that one of the jurors, though not himself in the old Sheffield trade, was filled with the traditions and prejudices of his family, who were.

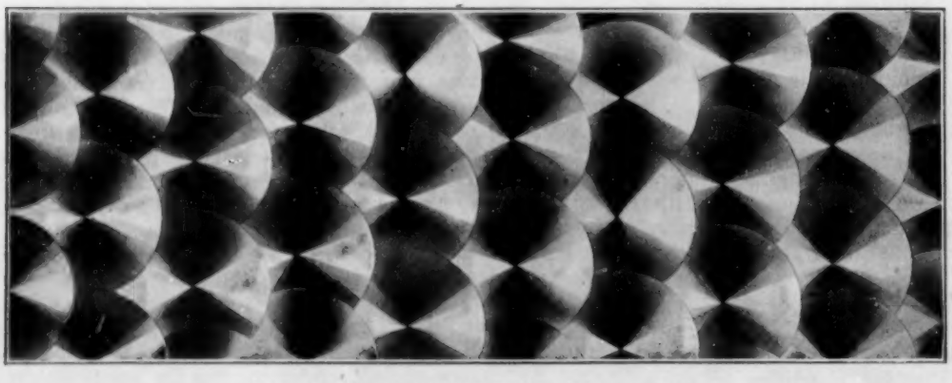
Reference has already been made to the statement of Josiah Mason's biographer, Mr. Bunce, who was intimately acquainted with Birmingham men and things, that at first the Elkingtons proposed to leave the mercantile development of Wright's silvering process to others, rather than themselves to manufacture ordinary household wares. This may be interpreted as indicating that their ideals soared beyond the utilitarian to the artistic possibilities of electro-plating. Each partner continued his own separate and earlier business. Mr. George Elkington has his "toy trade"—a comprehensive local description, including, one gathers, much ornamental knick-knackery. And to the end of his life Mr. Henry Elkington carried on his plastic art works; and gilding, rather than silvering, seems to have been the first love of both. Again, in 1838, George Elkington is found in close alliance with Ogle Barratt, working the first of a series of patents for improvements in coating and covering metals, especially covering iron and copper with zinc. In 1840 he is engaged with Alexander Parkes in adopting a method "for procuring copies of figures by voltaic electricity," and another in 1841 "for producing works of art in metal by electric deposition."

MOTTLED OR SPOT FINISH

A prominent metal working company was recently called upon to handle a job of polishing which included a certain amount of "jiggering." It was new work for them, so they laid their difficulties before the writer.

What they were particularly interested in was the method of handling this work, what the proper apparatus was, and where procurable, and just how the operation was performed. Also, they were at a loss to know just what spacing was proper; that is, whether the outside lines of one circle group should strike the center of the next, or whether this was not absolutely necessary just so long as the spacing was uniform. They had been doing a little experimenting with this work, using a drill press, but had not obtained satisfactory results.

They were advised as follows:—



SPOT FINISHED OR MOTTLED SHEET BRASS.

The job you refer to and finish desired is a mottled or spot finish, which you will find is employed or applied on high-grade machine tools, on certain parts of same, and the method employed is using a drill press with a round piece of hard wood and applying powdered emery to the surface. Where the surface is large, an electric or pneumatic hand drill can be used. There is a possibility of using in place of the round piece of wood and ground emery, a solid stick of emery the desired diameter and grain. This would give the desired finish and reduce the cost. Mottled colors on steel can be produced by heating the objects to a good cherry red for several minutes in cyanide of potassium, then pouring the cyanide off and placing the receptacle containing the work back on the fire for five minutes. The contents are then dumped quickly into clean water. To heighten the colors, boil afterward in water and oil. Another method for obtaining a fine mottled effect on steel is first to highly polish the object to be treated, after which it is very carefully cleaned from all grease in a hot soda solution. The object is then heated to a high temperature of from 150 to 200 deg. by placing it, say on hot fire brick covering on the top of a furnace and then putting it in a pot of heated cyanide of potassium, and bring it to a dark red heat. It is then dipped into clear water and vigorously moved about in the bath. Unless the work is moved about in the water the mottled effect will not be obtained.

In regard to the spacing on a spot finish, the outside lines should strike an equal distance from the circle group to allow no blank space to appear on the surface, and keep a uniform appearance. The illustration shows clearly how the sheet should look after jiggering and finishing.

P. W. B.

EDITORIAL

Vol. 18 New York, January, 1920 No. 1

THE METAL INDUSTRY

With Which Are Incorporated
THE ALUMINUM WORLD, COPPER AND BRASS, THE BRASS FOUNDER AND FINISHER, THE ELECTRO-PLATERS' REVIEW
Published Monthly
Member of Audit Bureau of Circulations

Entered February 10, 1903, at New York, N. Y., as second class matter under Act of Congress March 3, 1879

SUBSCRIPTION PRICE, United States and Canada $1.00 Per Year. Other Countries $2.00 Per Year :: SINGLE COPIES, 10 CENTS
Please Remit by Check or Money Order; Cash Should be Registered

ADVERTISING RATES ON APPLICATION
FORMS CLOSE THE FIRST OF THE MONTH

Palmer H. Langdon ..... Editor and Publisher
Adolph Bregman - - - - - - - - - - - Managing Editor
George W. Cooper ..... Advertising Manager
Thomas A. Trumbour ..... Circulation Manager

ADDRESS ALL CORRESPONDENCE TO
THE METAL INDUSTRY, 99 JOHN STREET, NEW YORK
Telephone Number Beekman 404 Cable Address, Metalustry

CONTENTS

EIGHTEENTH YEAR

We start our eighteenth year with a 200-page paper—the largest we have ever issued. The edition is 6,500 copies.

We believe this number is quite unique inasmuch as we present a series of articles from the pens of our expert editorial staff.

Our new managing editor, Adolph Bregman, begins a series on the present day methods of conducting the metal business, a subject with which even metal men may be unfamiliar. Our metallurgical editor, Jesse L. Jones, presents an article on the problems of alloying, which are forever problems to the metail mixer. Our foundry editor, William J. Reardon, writes on typical foundry problems. As Mr. Reardon has been for years superintendent of the largest brass foundries in the United States, he knows how to solve such problems. Our mechanical editor, Peter W. Blair, describes the principles and practice of oxy-acetylene work as applied to metals. Mr. Blair is a practical brass finisher. Our plating editor, Charles H. Proctor (who has been writing for THE METAL INDUSTRY for the past fifteen years and has probably written more on metal and plating shop practice than any other one man), brings to the attention of our readers the present importance of using cadmium in combination with silver plating. The year's progress in metals is recorded by our research editor.

Besides what has been written by our technical staff, we present a number of valuable articles by our best contributors, both new and old. One of Mr. Knox's series showing the time required on plating deposits is presented. His series of tabulations are attracting the attention of the plating world. An old-time contributor, A. F. Saunders, tells us the interesting story of the knife and fork. Gilbert Colville Shadwell, a new contributor, advocates and describes soft metal melting by gas, and Parker D. Handy, president of the corporation of Handy & Harman, reviews the silver situation for 1919, in which there is considerable commercial information of particular value to the business world. The early history of electro-plating by R. E. Leader, of Sheffield, England, completes the series of our principal articles.

Our correspondents record the business conditions at the ending of the old year and the outlook for the new, while our metal market editor, W. T. Partridge, reviews the price conditions of 1919 with the outlook for 1920. The reading matter ends with prices and statistics.

The 136 pages of advertising indicate a great deal of care and preparation on the part of our advertising department to have all of the advertising attractive and correct in every respect. The advertising itself is a guide of where, what and how to buy in the line of metals, machinery and supplies needed for carrying on the metal business.

The distribution of this number will be to the leading metal and plating shops of the United States and Canada, and other metal shops throughout the world where the English language is read.

Taken all in all we are confident that we have surpassed all former efforts to make THE METAL INDUSTRY larger, better, more interesting than ever, and this number merely bespeaks what is to follow throughout the year 1920.

RETROSPECTIVE REVIEW OF 1919—OUTLOOK FOR 1920

Very quickly after the signing of the armistice business stopped and held its breath. With the cancellation of the war contracts came a depression, which, although comparatively short, was acute. The metal industries, which had been so closely identified with the making of munitions, were especially affected by this condition. After several months of waiting, however, industry began to revive. The consummation of peace was still delayed, and although business could not move confidently until peace was definitely settled, it preferred to move hesitatingly rather than not at all, and little by little work has been resumed.

METALS IN 1919.

Restrictions on metal prices remained until the government had disposed of its surplus stocks. Their removal was the signal for a sharp decline followed by the gradual rise back to normal.

Copper and tin are now on a firm basis, but considerably higher than the pre-war figures. Lead, zinc and antimony seem to be on the upgrade. Aluminum and nickel are solid. Silver, after considerable fluctuation, has taken a tremendous turn upward. The governing cause in its rise is the foreign demand, chiefly for coinage purposes, which has forced it above its point of parity with gold. Platinum, due to the cutting off of the main source of supply, Russia, and the depletion of the existing stocks, has been rising steadily and swiftly during the last few months.

Because of the previously mentioned unsettled conditions, and because of the additional difficulties, such as labor troubles, the production of metals during the past year has been much lower than in 1918. This, however, is not extraordinary, nor should it be alarming, as 1918 was a year of tremendous expansion to provide for machinery and ammunition which was being destroyed almost as fast as it was manufactured. The past year represents a return to normal production, for normal purposes, a much healthier condition.

MILLS IN 1919.

There was but one large rolling mill projected during the last year, the West Virginia Metal Products Corporation, Fairmount, W. Va., which is to have a capacity of 100,000 pounds of metal per eight-hour day. Most of the expansion consisted of the enlargement of old mills and shops. A number of small casting shops were organized, of course, especially during the business revival of the last few months, among which was the Thinsheet Metal Company of Waterbury, Conn., for rolling thin gauge metal. The Union Smelting & Refining Company moved into its new and greatly enlarged plant in Newark, N. J.

NEW DEVELOPMENTS IN 1919.

Investigation has been carried on along numerous lines, such as the development of aluminum alloys, and of magnesium alloys and the increased knowledge of their properties; the increased use of scavengers and deoxidizers for molten metals which had previously been known, but little used commercially. Die-casting has been carried on to an increased extent, but as yet the commercial die-casting of brass and bronze is still an unsolved problem.

An important development, which, however, is not peculiar to this last year alone, is the increased use of fluid fuels (oil or gas) instead of coal.

ELECTRICAL FURNACES.

The outstanding feature, however, is the very large increase in the number of users of electric melting furnaces and ovens. Over a hundred of the Ajax-Wyatt furnaces alone are in use. The Baily, with 61 furnaces, has a total rating of almost 7,000 k. w. and a total production of more than 600 tons per day. The Detroit Rocking, with 46 furnaces in use, the Booth, Moore, Rennerfelt, General Electric, Snyder, Greaves,Etchells, Ludlum and Greene furnaces are also adding rapidly to the number of installations for the electric melting of metals. In addition to melting, electricity has invaded the field of the heat-treating furnaces and ovens. Several concerns manufacture annealing and hardening furnaces and electric core ovens, enameling, lacquering and japanning ovens.

At the Foundrymen's Convention in Philadelphia, in September and October, the exhibition of the new machinery proved conclusively that manufacturers had again recovered their confidence, and were going ahead with all possible speed. The biggest feature, however, was the development of the electric furnaces, and this field seems to show the most promise for the coming year.

A number of problems still remain to be solved, among them are the die-casting of red metals mentioned above, and the control of corrosion, the latter having been discussed at some length in the October meeting of the Institute of Metals Division in Philadelphia. Much work still remains to be done on electric furnaces, in order to fit them for different types of metals and to make them more flexible than they now are, but the year's progress has been notable.

The progress in electroplating has been chronicled by Charles H. Proctor in this issue of THE METAL INDUSTRY.

INDUSTRIAL PROBLEMS.

Unquestionably the most important problem of the past year to the metal industries, just as it has been to other industries, is the problem of labor. The last twelve months have been a period of unrest and turmoil. There have been strikes in almost every industry. At one time there were over two million men out. Just what this condition was due to can be answered, and has been answered in far too many ways to repeat in detail. The fact is, however, that a condition of acute industrial unrest exists, and that forward looking business men are putting their minds to this problem as they have never done before. Labor has become a problem for consideration and management demanding specialized supervision, and careful handling instead of simply being taken for granted, as it once was. Just what the final solution of this problem will be is too much for anyone to predict. The best statement of the whole cause that has come to our attention is that drawn up by the National Conference of Business Paper Editors at their New York meeting in January, which they briefly enumerate as follows:

A. Causes.
  1. Affecting the Individual.
    a. Unsatisfactory wage, unjust division of income of industry.

b. Improper working hours.
c. Improper working conditions.
d. Irregular and insecure employment.
e. Impossibility of advancement.
f. Unjust, arbitrary and autocratic management.
g. Profiteering and high cost of living.
h. Lack of contact between owner and employee.
i. Monotony of modern factory employment.

2. Affecting Society as a Whole.
a. Disloyal and revolutionary propaganda.
b. Mental disease and character defects.
c. Ignorance of industrial economics.
d. Suppression of individuality.
e. Repression of normal instincts.
f. Motive of "production for gain alone."

B. Remedies.
1. Within Industry.
a. Wage payment and profit-sharing plans.
b. Basic eight-hour day plans.
c. Trade unionism and collective bargaining.
d. Organization of employer-employee relationship, personnel activities, shop committees, industrial democracy.
2. In Which the Public Participates.
a. Federal inquiry and adjustment.
b. Motive of "production for service to society as a whole.
c. Aroused public opinion to protect the nation against minorities and to secure justice for all.

EFFICIENCY STRIDE.

One of the greatest strides ever made by mankind for increasing the efficiency of employer and employee, especially the working man, was the enactment and enforcement during the war of the prohibition amendment to the Constitution of the United States, by operation of which the manufacture and sale of alcoholic beverages will cease. For years we have been reading, and some of us preaching, how imperative it was for the workman and manager to keep sober, and how necessary for the health of each to abstain entirely from drinking the injurious concoctions which were put upon the market in such ample supply. But at the same time that the country was preaching temperance, temptation was forever crossing the path of everyone, for nothing was easier to get in about all of the States than a drink of whiskey.

With the complete enforcement and operation of the prohibition law, this temptation to drink should entirely disappear, which should mean increased efficiency by the factory operative in every position in the shop. Economically the releasing of millions of acres of land which were required for the manufacture of harmful beverages—and the use of this land for the production of nourishing foodstuffs which are desperately needed should ultimately bring down the high cost of living, which, of course, is greatly desired by all metal manufacturers and their assistants.

Another great economic waste which in time may be stopped by legislation like the liquor traffic, is the tobacco industry which at present requires over 1,400,000 acres of American land alone to supply the consumption of that product when at present we have not sugar enough to satisfy the demand. Likewise, careless smoking has caused latterly a fire loss of over $8,000,000 a year at the very time when every effort was being made to stop losses and wastes of all kinds. The sign "No Smoking" has to be put in factories and public places, but is so frequently ignored that we have ever present with us the peril of fire and the befouling of breathing space; consequently, when the tobacco temptation is taken from men as the liquor temptation has been, we may all look forward to greater efficiency and greater safety in factory life and management which will be as great an asset to the metal industry as any other.

CHRONOLOGY.

A number of men of prominence in the metal industries died during the past year. Among them were Louis G. Pothoff, president of the U. S. Electro-Galvanizing Company, Brooklyn, N. Y.; E. L. Strauss, president of the Century Brass Manufacturing Company, Cleveland, Ohio; Henry W. Scovill, of Waterbury, Conn.; Emanuel Blassett, Jr., of Burlington, Vt., consulting electroplater and widely known writer on electroplating subjects; Edward Holbrook, Strawberry Hill, Conn., president of the Gorham Manufacturing Company; Martin J. O'Connell, president of the Bennett-O'Connell Company, Chicago, Ill.; Fred W. Haskell, president of the Carborundum Company, Niagara Falls, N. Y.; Joseph Sillman, president of the Michigan Smelting & Refining Company, Detroit, Mich.; David R. Daly, president of J. H. Gautier & Company, D. G. Gautier, vice-president of J. H. Gautier & Company, crucible manufacturers, Jersey City, N. J.; Otis S. Northrup, Waterbury, Conn.; John F. P. Lawton, secretary of the Gorham Manufacturing Company, Attleboro, Mass.; George C. Edwards, vice-president of the International Nickel Company, Bridgeport, Conn.; Major Albert F. Brooker, former superintendent of the Coe Brass Branch, Torrington, Conn.

OUTLOOK FOR 1920.

The general tone of our business correspondence, published elsewhere in the outlook for 1920, is most encouraging. Mills and manufacturing plants are running at top speed, and deliveries lag far behind orders. The moving idea seems to be expansion and increasing size to obtain more capacity. Undoubtedly the great need of business today is production. There is a shortage which will take a long time to overcome; the heavy demands made upon us by disorganized and struggling Europe will provide us with a foreign outlet for some time. Just how long this market will last, and just what we shall do when it declines, are most important questions. In some quarters opinion is strong that the next year will see European manufacturers on their feet, a strong reduction in exports, from this country and an increase in imports. One other important feature which must be reckoned with is the rate of exchange. So long as European money is worth so much less than its face value here, and will buy so much less than it is accustomed to, Europe will be loathe to buy from us. "The time is fast approaching when, with normal conditions of international commercial competition, American goods must, as of old, sell strictly on their merits, and not because buyers must have them at any cost," is the opinion of the Guarantee Trust Company of New York.

The domestic market is still strong, and from all indications there will be no customary pre-election lull. It seems that business has finally decided to wait no longer for politics, but to go forward with its own problems and settle them as it sees best. In which we wish it Godspeed.

REVIEW OF THE ELECTRO-PLATING INDUSTRY FOR 1919

WRITTEN FOR THE METAL INDUSTRY BY CHARLES H. PROCTOR, PLATING EDITOR.

In reviewing the electro-plating industry for 1919, the writer, like many others, gives thanks that we have passed safely through a year which in its beginning seemed portent with many dangers. In modern history following all great wars, industrial and financial chaos has always followed in their wake, during the reconstruction period; but it is remarkable that through all the industrial strife during the past year when it seemed that Liberty was going to pieces, our nation's bark has been steered clear of the disastrous storms that were appearing on the nation's horizon. But the star of our destiny leads us onwards always with its guiding and protecting gleam, that has made us what we are, the greatest nation upon which the sun ever shone.

The New Year starts out with unusual promise. If we can only keep our heads clear, we shall find ample work for our hands to do.

Our dollar is still the greatest basic factor in the financial world. Even when the standards of other nations have depreciated, the dollar still represents a hundred cents. Its purchasing power, however, is much lower than a few years ago. Statistics prove that even with almost a 100 per cent increase of wages in the various lines of industry the production of the individual has fallen from 10 per cent to 25 per cent and even more when compared with production of pre-war days. So if we want to increase the purchasing power of the dollar and decrease the high cost of living it must be upon the basis of a much larger percentage of production than has prevailed during the past year. A great efficiency in production at the present high price of labor can only reduce the high cost of living, and still maintain the present hours of labor and high wages being paid.

Through all the industrial strife of the past year it is remarkable that the electro-plating industry has been less affected than any other line. The men have created less agitation and have been strong supporters of their employers in an effort to equal the demand in production that business prosperity has imposed upon them.

Their motto, "Knowledge is Power," and a higher education in their adopted profession through their membership in the American Electro-Platers Society have done much to stabilize them as efficient producers in the respective field of industry. Although there is less change in the chemistry of electro-plating, than was noted for 1918, the mechanical features have made steady progress in the Middle West. This is particularly noticeable in automobile production.

Five of the greatest automobile rim producers of the country have under consideration the installation of complete mechanical units for zinc plating their steel automobile rims, and parts, in place of the present regular still tanks, which required the rims to be turned frequently by manual labor or by a revolving cathode to the more efficient and greater producing capacity at a greater reduced cost of the mechanical cleansing, pickling, washing, plating and drying unit.

The first unit of this type was recently started in one of the great rim plants in Cleveland. The entire unit is approximately 120 feet long, has alkaline cleansing solution, wash water, pickling solution, a zinc plating solution of 3,500 gallon capacity, washing and drying tanks of cold and boiling water. The rims are placed upon the cathode supporting hooks at one end of the unit by one operator. Of the small type of rim such as the Ford two rims are placed upon the cathode hooks so that when the rims reach the end of plating tank ready for the final washing, and drying operations there are one hundred and four rims in the plating solution at one time. It requires approximately thirty-five minutes from the time the rims are placed upon the cathode hooks at one end of the tank by the operator until they have reached the hands of the operator at the extreme end of the tank ready to be loaded upon the railroad cars for delivery at the automobile plants where the auto cars are constructed.

The actual deposition requires from nine to ten minutes, so it can be readily computed that a unit as outlined can deliver 5,000 rims per day of nine hours. The type of solution that so far has been found best adapted for such units is the zinc cyanide solution even with as low a metal content of three and a half ounces of zinc per gallon of water. An amperage of 25 to 40 amperes per square foot of surface is readily obtained, at 5 to 6 volts. With a greater metal content up to five or six ounces per gallon, a much greater efficiency can be obtained. The high conductivity of this type of solution with its uniform deposition of the zinc over the entire rim surface makes it particularly adapted for such units. The agitation of the solution due to the constant movement of the rims keep up a high anode efficiency with the use of standardized methods of replenishing of the solution each day efficient electrical control with volt ampere and ampere hours meters a standard weight of metal can be deposited in a given time, that can be made thick enough to withstand long constant wear and corrosion tests.

At one plant where ten mechanical units will be finally installed with a daily production of 50,000 rims per day of nine hours, it was interesting to note that the cleansing before plating will consist of removing the oils and greases with strong boiling hot alkali solutions, washing in boiling water and raising by an elevator system to a sand blasting apparatus which automatically sand blasts the rims in one turn. The rims then pass along by gravity to the plating solution.

The pickling operation with the resultant washing in water is entirely eliminated and a clean surface to the rim always assured free from impurities upon the metal surface.

I have spent more time in an explanation than intended, but in this one particular line it will give to my readers some idea of the possible mechanical developments in other lines.

Standardized methods have come to stay. It is up to the individual plater to develop the method to suit his own particular case. "It can be done. It is being done." As a greater producing factor it is up to the plater to do his share in the forward movement of progress.

In the plating of articles of personal adornment, silver, gold, green and rose gold effects predominate. Platinum is the metal pre-eminent as the aristocrat of wealth to those who can afford to pay the price. In the cheaper lines splendid imitations are now being produced. Sterling silver is used as a base. The metal is then protected with a deposit of tin and nickel, this combination produces a color equal to platinum in effect and is sold under the name of "Platinoid" finish. Silver is a king among metals; its high price at the present time instead of lowering the demand for the thousand and one articles made from the metal has only served to increase its popularity, and manufacturers in the various lines have reported they have been unable to meet the demand of their customers.

Personally I believe the upward price of silver has reached the limit and during the first three or four months we may expect a decline only to increase again as the year advances. In the electrical fixture and the allied lines all types of finishes are prevalent from antique greens to rose and Ormulu golds. The polychrome finish still holds an important place in the art production of metal goods. Many antique finishes with all sorts of given names of the ancient and Oriental are to be found upon the market. The lacquer manufacturers in their advanced production of pigment enamels have enabled the art metal goods manufacturers to add to their respective lines in endless variety.

Silver will be used more extensively upon electrical fixtures and art metal goods during the coming year. The production of metallized plaster art goods is still on the increase. Many splendid specimens of reproductions of Oriental art are now produced in endless variety.

We may sum up the year 1919 as one of progress. The lower cost of cyanides of sodium is welcome news to the consumer, but with a good healthy demand chemicals as a rule will not be any lower in price.

The work being done by the American Electro-Platers Society is commendable, as it marks a progress in the electro-plating industry.

The Government's interest in the art through the Bureau of Standards at Washington continues and the work of Dr. William Blum is certainly appreciated by the craft. His recent lectures before the various branches upon the subject of the structural formation of the electro-deposited metals have been enjoyed by all who have had the privilege of listening to him.

So the review of 1919 is closed with the hope and anticipation that with the elimination of the spirit of unrest in 1920, the plating industry and its allied interests will go forward upon the wheels of progress with a happy ending on December 31, 1920.

CORRESPONDENCE AND DISCUSSION

While we cordially invite criticisms and expressions of opinion in these columns, THE METAL INDUSTRY assumes no responsibility for statements made therein.

RUST PROOFING

To the Editor of The Metal Industry:

I have recently been making an investigation covering patents relating to the use of phosphoric acid in rust proofing.

In the course of this investigation, I ran across Mr. C. H. Proctor's article in The Metal Industry of June, 1918, in which he states that a phosphoric acid process has been used for more than thirty years at the Frankfort Arsenal, Philadelphia, Pa.

I also ran across a note in The Metal Industry of April, 1911, under "Shop Problems," signed "C. H. P.," in which he gives a formula for a rust proofing solution which is substantially the same as that given in the Coslett patent No. 870,937 of November 12, 1907, and he states that this formula is used extensively in the manufacture of tools and hardware.

I have made some investigations of my own at Frankfort Arsenal, and cannot find that they used phosphoric acid prior to 1911. They adopted this formula from your article of 1911, which I have just referred to. I am very anxious to find out whether or not any formula involving phosphoric acid, was ever used commercially in rust proofing prior to the date of the Coslett patent, and his articles lead me to believe that he has been familiar with the use of this phosphoric acid process for some time prior to the date of his article.

Any information which you can give me on this subject will be greatly appreciated.

Philadelphia, Pa., Oct. 7, 1919. C. B. Des Jardins.

To the Editor of The Metal Industry:

I have no authentic date as to when phosphoric acid was first used in the production of a deposit of phosphate of iron by the boiling method in connection with water, in America. There are platers who claim to have used the method prior to the granting of the Coslett patent in the United States in 1907, but I have been unable to get any authentic dates.

My article published in June, 1918, together with the old patent of De Busby, leads me to believe it is the basis of the Coslett patent. It mentions the phosphates. Why not phosphoric acid?

There was a patent granted a few years ago based upon the used of acid calcium phosphate. The proportions I believe were two pounds per gallon of water. The same results were obtained as with the so-called Parker Rust Proof method. If this patent is legal, then why not phosphoric acid, based upon the claims of the old patent referred to, which presumed to cover any method for coating iron or steel to produce a rust proof coating.

New York, November 12, 1919.

Charles H. Proctor.

AN OLD FRIEND

To the Editor of The Metal Industry:

Pardon me for not forwarding my subscription to your valuable book sooner.

The Metal Industry will always find me a subscriber for I would be at a loss without it. It has been a great assistance to me many a time, and I am certain I have not missed being a subscriber in the past 19 years or more.

Thanking you again for all past favors rendered to me,

Buffalo, N. Y., Jan. 15, 1920. J. O. Speed.

NEW BOOKS

Applied Science for Metal Workers. By William H. Dooley. Size 5 x 7, 476 pages. Cloth binding. Price, payable in advance, $2. Published by the Ronald Press Company, New York City. For sale by THE METAL INDUSTRY.

This is the type of book which has a very definite place and a real mission to fulfill. It is perhaps misnamed; it might be called Applied Science for All Workers, as it is a general exposition in quite simple language of chemical and physical facts arranged in such form as to be easily understood by either the layman or the workman who has not had the opportunity for acquiring a background and education. It is necessarily general. So far as making him an expert in any specific trade or profession, it is, of course, unsuitable. Its object is not to perfect a man in any one industry; it is not detailed or over-technical. Its purpose is more educational, and this purpose it accomplishes well.

We believe that anyone who is not buried too deeply in his trade to notice developments and progress about him, would find this a most readable and useful volume. It will give him a broader vision and better perspective, and perhaps lead him into further studies, which might open further opportunities to him.

Techno-Chemical Receipt Book. Compiled and edited by William T. Brannt, and William H. Wahl. Size 5 x 7, 516 pages, 78 engravings. Cloth binding. Price, in advance, $2.50. Published by Henry Carey Baird & Co., New York City. For sale by THE METAL INDUSTRY.

A new edition of an old book, which has long held its place. It has been enlarged and revised to keep up with the latest practice. It needs very little comment because of the high standing it already has and the reputation of its authors.

The use of receipts and formulas is, of course, subject to difficulties and peculiarities, attendant upon the local conditions. It is very seldom that one can use a good formula without revision. However, its real purpose is to provide a standard and basis from which to work out the necessary experiments. Without such standards one might be at a complete loss where to start, as very often, though the first results are not completely satisfactory, it is possible to vary proportions in such a manner as to arrive at the desired results.

GOVERNMENT PUBLICATIONS

Bureau of Standards, Technologic Paper No. 142, "Materials and Methods Used in the Manufacture of Enameled Cast Iron Wares."

The sources, methods of preparation and properties of raw materials used in white enamels for cast iron and their effects in the enamel composition are discussed. Methods of calculating enamel formulae and examples of enamel compositions of various types are given. The defects in enamels, their causes and remedies are discussed from both the theoretical and practical standpoints. Manufacturing methods and equipment used in compounding and applying the enamels and in making and preparing the castings are described.

Technologic Paper No. 135, Bureau of Standards. The Behavior of Wrought Manganese Bronze Exposed to Corrosion While Under Tensile Stress, by P. D. Merica, Physicist, and R. W. Woodward, Associate Physicist, Bureau of Standards.

Specimens of wrought manganese rods were exposed in special test frames for a period of two years to corrosion in water and moist air, while at the same time under tensile stress with the object of determining the maximum safe stresses for this material under these conditions. None of the test specimens fractured within this period under stresses below the proportional limit or below 35,000 lbs. sq. in. Two specimens fractured, one under 40,000, the other under 43,000 lbs. per sq. in. tensile stress.

Bureau of Standards, Circular No. 35, Fourth Edition, entitled "Melting Points of Chemical Elements and Other Standard Temperatures."

This table of melting points of the elements and other fixed temperatures is based upon a careful survey of all literature, and in the opinion of the Bureau of Standards represents the most probable values.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

COLORING

Q.—I have heard of a marine finish. If you know what kind or color it is please let me know. Please tell me where I can get a set of standard colors in paints, varnishes and acid work.

A.—A marine finish, frequently termed a navy bronze finish, is a steel bronze color usually produced from the arsenic type of solution, either alkaline or acid. If the marine fixtures are made from bronze or brass all that is required as a basic finish is a uniform bright acid dip. After dipping and washing thoroughly in water the fixtures should be plated in a regular white nickel solution for a few minutes and then finally plated in the arsenic solution until uniformly plated. The time of plating is not more than five minutes.

After plating as noted and thoroughly washing and drying, the fixtures should be lacquered. A lacquer containing considerable gum gives the best results. What is termed a heavy brush brass lacquer will answer the purpose. The formulas most commonly used are composed as follows:

ACID SOLUTION.

Muriatic Acid	1 gallon
White Arsenic, powdered	1 lb.
Single Nickel Salts	2 ozs.
Water	1 quart

The solution is prepared by dissolving the arsenic in the acid by the aid of a low heat, hot water bath preferable. When the arsenic is all dissolved add the water and the nickel salts. The nickel salts should be previously dissolved in a little hot water.

If a deeper black is desired add ½ oz. sulphate of copper per gallon of solution prepared as stated.

Use nickel or carbon anodes. The solution should be run at normal temperature at 2 to 3 volts.

ALKALINE SOLUTION.

Water	1 gallon
Sodium Arsenate	8 ozs.
Sodium Cyanide 96-98%	4 ozs.
Caustic Soda 74-76%	2 ozs.

Use carbon or nickel anodes. Normal temperature, two to three volts.

We do not know where you can get a set of standard colors. Metal Coloring and Bronzing, by Arthur H. Hiorns, is an excellent work on metal coloring by the chemical methods. For coloring by the pigment methods, paints and varnishes, The Painter, Gilder and Varnishers' Companion, by William T. Braunt, is an excellent work.—C. H. P. Problem 2,776.

MELTING

Q.—I am melting white metals, namely, nickel, tin, zinc, antimony and aluminum. I use charcoal melting in crucibles. I am going to use reverberatory furnaces. I would like to know if charcoal will protect aluminum in such a furnace? Is there any flux you know of for aluminum?

I am shortly going to run copper and bronze. I want to use phosphorus. Do you use phosphorus as a flux? How is it used? Please tell me what Muntz metal is? Can zinc be melted in reverberatory furnaces to good advantage? Please tell me what Government bronze is?

A.—1. While charcoal will protect aluminum in crucible melting it is not practical to use it in a reverberatory furnace as it is soon burnt or blown off the surface. Furthermore, it is so light and aluminum is so light that the charcoal is apt to be mixed with the metal. The best flux to use on aluminum in a reverberatory furnace is chloride of zinc, mixed with slag from previous meltings.

2. Phosphorus is used not as a flux, but as a deoxidiser to reduce oxide of copper which may have been formed in the melting and the best form to use this material in is as phosphor copper or in the case of a bronze, as phosphor tin. Both of these products can be bought from metal dealers some of whose advertisements you will find in THE METAL INDUSTRY.

3. Muntz metal consists of 60 parts of copper and 40 parts of zinc.

4. While zinc can be melted in a reverberatory furnace it is not advisable to do this except as a smelting operation because the loss by oxidation is too great. You will find in Gowland's book a description of how zinc may be refined in a reverberatory furnace, but the process is too long to describe here.

5. There are a number of bronzes that are used by the Government and it is difficult for us to say which one you have in mind. The one that is commonly spoken of, however, is known as the 88 copper, 10 tin and 2 zinc mixture, and this composition is used for various purposes by both the navy and army is known as "Gun Metal Cast or Composition G."—K. Problem 2,777.

MOLDING

Q.—We would like to have a recipe for making Barberry. I believe that is what they call it. It is to be painted on patterns to give a smooth surface and to insure a good lift.

A.—Patterns that are intended for repeated use are varnished to protect them against moisture, especially when in damp molding sand. The varnish used should dry quickly to give a smooth surface that readily draws from the sand. Yellow shellac varnish is generally used. It is made by dissolving gum shellac in grain alcohol. Brass or metal patterns on plates are coated with the same preparations when being put away after being in use.—P. W. B. Problem 2,778.

PLATING

Q.—We have some brass air gauges which we wish to color black. We have been using copper carbonate-sodium carbonate dip, which does not give a glossy finished black. We have also tried to plate with black nickel, using a double nickel salt. Will you please recommend a dip or give us data for black nickel plating?

A.—The most satisfactory finish for your purpose would be the black nickel finish. This finish is best applied to a basic white nickel finish. In other words, the brass gauges should be highly polished, cleansed and plated in the regular nickel solution for a few minutes, then washed in cold water and plated in a black nickel solution of the following composition:

PART NO. 1.

Water	⅞ gallon
Double Nickel Salts	6 ozs.
Single Nickel Salts	1 oz.
Ammonium Chloride, 99-100%	1 oz.

PART NO. 2.

Water, Hot	⅛ gallon
Zinc Sulphate	1 oz.
Sodium Sulpho-Cyanide	2½ ozs.

Dissolve separately and mix to form one gallon solution. Use nickel anodes and a voltage not exceeding 1 volt. Three or four amperes per square foot of surface. A good deposit should be obtained in twenty or thirty minutes.

To remove the brownish tint that oftentimes develops in black nickeling immerse the articles after plating and washing in a dip of perchloride of iron for a moment or two. Water 1 gallon, perchloride of iron, 2 ozs.

To avoid stains it is advisable to eliminate the boiling hot water immersion in drying out. Use cold water and then benzine, gasoline or denatured alcohol, or cold water only and then dry in maple sawdust.—C. H. P. Problem 2,779.

Q.—We want to nickel plate zinc strips 9 foot by 1" wide used for running boards on automobiles. We want to keep using the same solutions for plating on brass, copper or iron, without making any changes in the solutions. We understand several parties are plating nickle on zinc and that is what we want to find out, if you will please give us the proper way to proceed with this we will be grateful for such information.

A.—It is somewhat more difficult to plate the metal zinc in an ordinary nickel solution used for brass, copper or iron. You can, however, improve the qualities of your present solution for plating zinc by adding about 1 oz. of sodium citrate per gallon of solution. This addition will make the solution more conductive and prevent the deposition of nickel sulphide, which causes black streaks to a great extent.

The following manipulations must be followed in plating zinc in your present solution even with the addition of the sodium citrate: 1. Cleanse the zinc in a mild cleanser such as Oakite or O. P. C. 2. After cleansing and cyanide dipping, plate for a few minutes in a brass solution prepared as follows:

Water	1 gallon
Sodium Cyanide	4 ozs.
Copper Cyanide	3 ozs.
Zinc Cyanide	1 oz.
Soda Ash 58%	1 oz.
Ammonium Chloride 99-100%	⅔ oz.

Use brass anodes. Voltage 3 to 4. After washing plate direct in the nickel solution.—C. H. P. Problem 2,780.

SMELTING

Q.—Will you kindly advise if babbitt and stereotype drosses can be run through a lead cupola furnace without losing the tin or antimony ingredients?

We are now running this material through a reverberatory furnace and we are wondering if we cannot lower our cost by running same through a lead furnace.

A.—In order to operate a lead blast furnace or cupola, as you call it, it is necessary to have sufficient quantity of material for an extended run of 24 hours per day. The lead blast furnace is not operated like the iron cupola which can be blown in and out every day. It is a continuous process and does not pay unless the runs are extended for weeks at a time. It can be built in sizes from 25 tons a day capacity up.

It has been the experience of most lead smelters that the smaller furnaces are much more difficult to operate than the larger ones. Although, of course, this applies to a great extent to the smelting of ore, in the case of drosses it might be different.

There is no question that you can get much greater capacity from a blast furnace than from a reverberatory. It is obtained, however, at the cost of much higher volatilization losses, not only in antimony and tin, but in the lead itself.

There may be smelters which are operating cupolas for lead drosses. In fact, we have heard of such installations, but these places have always been very careful about giving out any information, and we have been unable to obtain any real data.

If you were in a position to do any experimental work, it might be a good plan to build a very small cupola, which would hold a few hundred pounds or less and try it out on that scale. Such an investigation, although, it would cost something to install, might prove immensely valuable in the results obtained.

As a matter of interest we have the following statement taken from the English reference, "The losses in the case of lead where no arrangement is made for fume condensation amounts to about 15 percent of the lead in the charge."

You can readily see that there would also be a high tin and antimony loss. The only question that remains is whether the increased capacity would pay for the higher loss and that is something that can only be found out by experiment.—A. B. Problem 2,781.

TINNING

Q.—Please tell us how we can tin brass castings by hot dipping.

A.—Tinning Brass Castings—Manipulations as follows:

Remove all sand by pickling in a warm solution, 120 degrees to 160 degrees Fahr., composed as follows:

Water	1 gallon
Hydrofluoric acid, 30 per cent	1 pound

After sand is removed wash in cold water and then immerse in a bright acid dip composed as follows:

Nitric acid, 38 per cent	1 gallon
Sulphuric acid, 60 per cent	1 gallon
Muriatic acid	2 ounces
Water	1 pint

Immerse in the bright dip for a second or so until the casting becomes bright. Remove, wash in water and immerse in the flux solution.

The flux consists of dissolving zinc scraps or sheet in commercial muriatic acid until no more will dissolve. When cold remove any lead that remains undissolved in the acid by filtering the solution through several thickness of cheese cloth.

To every gallon of flux so prepared add one-half pound of gray sal ammoniac. Immerse the cleansed casting into the flux, drain well and then immerse in the molten tin.

Heat the tin in an iron kettle to 500 degrees or slightly more. After the castings are tinned, remove, shake off the excess of tin and cool in boiling water to which is added about 1 ounce of carbonate of ammonia to every gallon of water, or cool in paraffine oil. Finally, dry out in maple wood sawdust.

If a high lustre is desired, a second coat of tin should be applied. This will mean a second kettle of tin. The tin in the second kettle should be covered to the depth of two inches with beef tallow or cocoanut or palm oil. The oils or tallow act as a final flux. The tin runs free and brighter. Cool as outlined and dry out in sawdust or a cheap wheat flour, usually sweepings.—C. H. P. Problem 2,782.

Q.—Our present process for tinning copper wire-sizes .030 to .289 is as follows: tinning pan is divided into three sections, first section containing muriatic acid solution, second section the molten tin, and third section water. We are miing with 10 gallons of muriatic acid 15 pounds of best zinc. The zinc to be used in cutting or abating in part the acid fumes, also to give the acid a better tendency to act as a flux. On top of our molten tin we place bituminous coal ash to retain the heat in the molten tin.

We have always been bothered with strong acid and moulten tin fumes in our tinning room.

Will you please suggest any known method or process used in tinning copper wire which would enable us to reduce the acid and molten tin fumes?

A.—In dissolving zinc in concentrated muriatic acid, large amounts of hydrogen are evolved and this carries an acid spray to quite a distance. As muriatic acid itself is simply a gas dissolved in water, the gaseous acid is given off freely at all times from the concentrated acid, especially when it is heated. This happens when zinc is added to it as the reaction produces quite a high temperature. Hence it would be desirable to dissolve the zinc in the acid, in a large earthen-ware jar or in an old alcohol barrel, in the open air and then transfer it to the tinning pan. Instead of using metallic zinc and muriatic acid, the solution could be made from chloride of zinc, a percentage of muriatic acid being added if desirable.

As both the muriatic acid fumes and the chloride of zinc fumes are rather heavy, hoods are not very saticfactory for removing them. A down draft arrangement can be made, however, that will be cheap and efficient. Run a wooden conduit, about four inches square, around the top of your tinning pan. Openings should be made in the conduit at intervals, and it should be connected with a lead lined exhaust fan. A coat of acid resisting paint will serve to protect the conduit. The fumes by this arrangement are drawn into the conduit near the point where they originate. This plan is in successful use in many plating rooms where dangerous acid or cyanide fumes are given off. J. L. J. Problem 2,783.

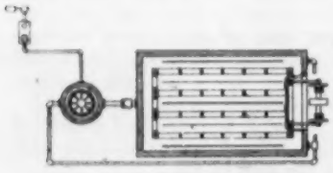
PATENTS

A REVIEW OF CURRENT PATENTS OF INTEREST

Due partly to the delay caused by the printers' strike, partly to the large number of patents published recently by the Patent Office in catching up with its work, and partly to the importance of other material, we have been forced to fall behind in our Patent Columns. We hope, shortly, to come up to date again.—Ed.

1,314,742. September 2, 1919. **Electrolytic Process.** William E. Greenawalt, Denver, Colo.

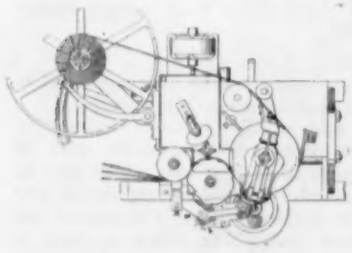
This invention relates to improvements in electrolytic processes and has for its more immediate object the more effective application of reducing gases during electrolysis.



In the electrolysis of impure copper sulphate solutions, as for example those obtained in leaching copper ores, there is always present iron sulphate, which injuriously affects the operation. Ferrous sulphate is not particularly harmful in the electrolyte, but the ferric sulphate is highly detrimental. In this process this is effectively and continuously overcome.

1,315,022. September 2, 1919. **Means for Forming Metal Ribbons.** Edward E. Johnson, St. Paul, Minn.

The invention relates to means for forming metal ribbons used in making well screens and has for its object to provide mechanism for arranging a multiplicity of shaped elements



which are wider at one portion than another, so that the narrowest portions will be turned in one direction and the elements held parallel and spaced a desired amount between their widest portions, together with mechanism for applying solder to said elements at intervals, whereby a continuous ribbon is formed which may be wound upon a perforated tube to construct a well screen.

1,314,710. September 10, 1919. **Process for Producing Aluminum Oxide.** Ralph S. Sherwin. East St. Louis, Illinois, assignor to Aluminum Company of America, Pittsburgh, Pa., a corporation of Pennsylvania.

This invention relates to improvements in the method of manufacture of aluminum oxide by the apparatus described in Patent No. 1,314,709.

1,315,045. September 2, 1919. **Production of Aluminum Oxide.** Ralph S. Sherwin, St. Louis, Missouri, assignor to Aluminum Company of America, Pittsburgh, Pa., a corporation of Pennsylvania.

The present invention has for its object to produce certain refinements in the operation whereby the separation of the coarse precipitate from the fine precipitate is made more complete, the removal of soluble material from the coarse precipitate prior to calcination is made more complete, and is accomplished more economically, and the entire process after the precipitation operation is rendered more nearly atomatic and reuires less attendance.

1,314,709. September 2, 1919. **Apparatus for Producing Aluminum Oxide.** Ralph S. Sherwin, East St. Louis, Illinois, assignor to Aluminum Company of America, Pittsburgh, Pa., a corporation of Pennsylvania.

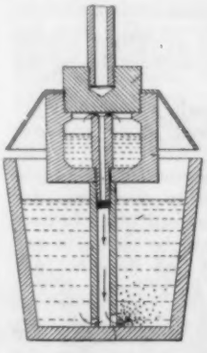
This invention relates to an improved means which not only facilitates the precipitation of aluminum hydrate but results in the production of particles or grains of hydrate which are uniformly coarse. The precipitate, produced by the methods now in vogue, consists largely and sometimes wholly of very fine particles. The large proportion of fine particles not only makes the precipitate difficult to filter and wash but also causes the loss of a considerable portion of aluminum oxide as a fine dust during the calcination and subsequent handling and makes conditions quite disagreeable for the workers employed in calcining and handling it. The invention forming the subject of this application therefore relates to improvements in mechanism for the manufacture of aluminum oxide designed to overcome the difficulties just referred to.

1,315,630. September 9, 1919. **Silver-Cleaning Cmpound.** George Koster, Philadelphia, Pa.

It has for one of its objects to provide a compound, the ingredients of which not only are cheap but may be readily obtained. In consequence of this a compound embodying my invention may be cheaply and economically manufactured.

A still further object of my invention is to provide a cleaning compound which may be easily used as well as one which has no injurious effects upon the hands of anyone who may use the same for the purpose of cleansing silver articles.

1,315,208. September 9, 1919. **Admixture of Metals or Substances for Alloying.** Edward Godfrey Burr, Montreal, Quebec, Canada.



This invention relates to the intr oduction of a volatilemetal or subst heated molten metal or substance for the alloying of the metals or substances, the invention appertaining particularly to cases wherein the volatile substance has a boiling point temperature approximating or lower than the melting point temperature of the heated molten substance, and the object of the invention is to accomplish the admixture of the volatile substance and the molten metal in a simpler and more efficient manner and under better control than heretofore.

1,315,206. September 9, 1919. **Art of Melting Metals.** William H. Bristol, Waterbury, Conn., assignor to The Bristol Company, Waterbury, Conn., a corporation of Connecticut.

The invention relates to the melting and alloying of metals, and is directed more particularly to the prevention of oxidation of the same during the melt.

It is known to provide for this purpose the gaseous products of combustion of the fuel employed to effect the melt, but difficulty is experienced in properly directing such products over the metal, the action is not satisfactory nor efficient, and, furthermore, the products of combustion tend to contaminate the metal by introducing undesirable foreign matter. It is the object of the present invention to provide and so direct a suitable and economical medium that the highly desirable result of practically obviating oxidation is attained without these detrimental features being present, said method effecting great saving and permitting of the carrying on of the melting in a more rapid and safe manner. To this end, there is directed over the surface of the metal, to provide a suitable envelope to exclude the air, a stream of steam, preferably dry and superheated.

EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

A NEW PLATING BARREL

The Merrick Steel Products Corporation, of Merrick, N. Y., is offering to the trade a new type of plating barrel, constructed along radically different lines than the barrels now in vogue.

The Merrick, as the barrel is trade named, was designed with the one purpose in view: to produce a plating barrel, eliminating

THE MERRICK PLATING BARREL.

any objectionable features, and offering new and essential features to insure a more rapid and uniform deposit.

Heretofore all of the modern plating barrels were similarly constructed, in point of admitting the solution. Perforated coverings were universally adopted by the various manufacturers.

The Merrick has no perforations and is designed to scoop up the rich solution continuously directly in front of the anodes, forcing the spent solution out at the opposite side of the barrel; thereby insuring an adequate supply of the rich mixture within the barrel and a continuous circulation of the solution in the tank. This aids the formation of a very rapid and uniform deposit.

One feature of the ordinary plating barrels has been the method of supplying current to the material to be plated. Chains, rods, weights, etc., have been used, to give the electrical contact to the material; some of these methods for the better, others for the worse. The Merrick eliminates all these methods of contact; there are no rods, chains, weights, etc., inside. Removable panels for charging and discharging, and the troublesome, spring operated doors, have all been done away with. The Merrick is automatically hopper charged in various positions and at various points, and upon reverse motion of the barrel, automatically discharges from various points, onto the chute which automatically advances to receive the plated material, thereby facilitating the handling of material and speeding the operation.

As the barrel rotates continuously in the solution, and automatically charges and discharges, it need not be removed from the tank; therefore, no hoists, chains, pulleys, etc., are necessary and it is claimed that one man can operate a battery of these barrels at full capacity, where formerly a number of men were necessary to operate and handle the material of one plating barrel, thus considerably lowering the operating and production costs.

Another advantage claimed is that there is a positive circulation and mixing of the solution, and the anodes at all times supply all the necessary metal content to the solution, maintaining it at the same standard of gravity, making it unnecessary to replenish the solution with costly chemicals, in order to maintain it.

The machinery offered by the Merrick Steel Products Corporation is in no sense experimental, but is the result and culmination of many years of experience in the electric plating industry. Mr. William Dietzel is president and technical director of the corporation.

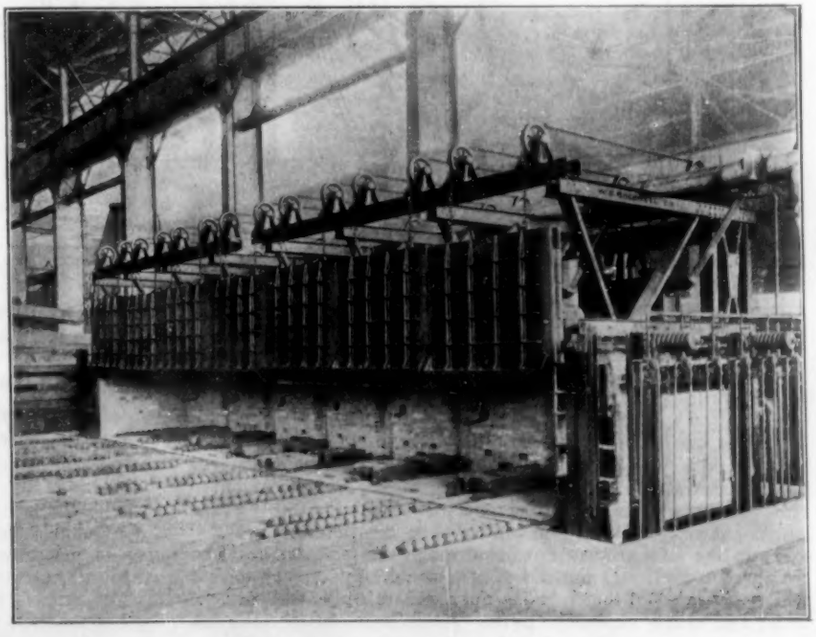
A NEW FURNACE CEMENT

The Buckeye Products Co., 919 West Fifth street, Cincinnati, Ohio, is calling especial attention at this time to a furnace cement of their manufacture which they claim is unequalled in heat resistance and extremely repellant to destructive combustion of fuels.

They recommend their Buckeye High Temperature Furnace Cement for lining and patching of brass and other non-ferrous metal melting furnaces of all descriptions, also electric arc, cupola, malleable, reverberatory, open hearth, converter, case hardening and annealing furnaces, gas, clay, and iron retorts, ladles, laying of fire brick boiler settings and other special shaped refractories. It is furnished in a dry form, requiring only the admixture of water for use. Laboratory tests have shown that this material withstands temperatures of over 3,200 deg. Fahr.

A NEW ROCKWELL FURNACE

This furnace is 36 ft. wide. Stock approximately this length may be placed in the furnace for heat-treatment, or the furnace may be partitioned off into individual chambers 5 ft. 9 in. wide or multiples thereof. Thus, while one chamber is heating stock



THE NEW ROCKWELL SIDE-OPENING FURNACE.

say 5 ft. long, the other part of the furnace could be heating stock either much longer than 5 ft. or smaller. The fact is, this furnace has proved so advantageous in operation that it is now being widened to provide a working chamber 105 ft. wide in the clear, the length remaining the same. This increased width will provide facilities to anneal and heat-treat the largest shafts and similar pieces handled in this forge shop.

The doors of the furnace can be raised or lowered independently of one another. They are operated by compressed air and counterweights. They are dovetailed and form guides within themselves that prevent the escape of hot gases.

The roof of the furnace is constructed of flat tiles, avoiding the thrust caused by the ordinary arch construction.

The furnace is underfired, assuring the most uniform heat-treatment. It is provided with preheaters over the vents. The air in these preheaters thus returns through the burners the greater portion of the heat in the spent gases that would otherwise be lost. The fuel consumption in this furnace is extremely low, due to the efficient application of the heat and the utilization of the waste heat ordinarily lost. Oil or gas may be used as fuel.

Expansion of the brickwork, or of the furnace as a whole, is taken up by the heavy springs shown at the side of the furnace. The overhead trusswork has been so divided as to prevent any distortion due to the heat in the furnace. It is manufactured by the W. S. Rockwell Company, New York City.

THE HEIL FOOT-AMPERE METER

The foot-ampere indicator is a device designed for measuring the current density of an electrode. In electrolysis, the quantity of substance separated at the electrodes is directly proportional to the quantity of electricity flowing through the electrolyte. This is according to Faraday's law, and so, in the electro-deposition of metals, the plater must know the current density so that he can figure the time necessary to deposit the required amount of metal on the cathode.

An ammeter connected in series with the plating tank will measure the total current flowing through the tank, but to learn the current density at the cathode, it would be necessary to find the surface area of the cathode. As a general thing, this is very difficult or nearly impossible to do. As an example, for instance, if the ammeter would read 144 amperes, the plater would not know if he were using 6 or 4 amperes per square foot of cathode surface because he does not know if the surface area of the cathode is 24 or 36 square feet or something else.

Then, again, if a suitable deposit is secured in one hour's time, unless the next load is an exact duplicate of the first in area of outside surface, the plater is guessing again.

The prime factors governing the weight of an electro deposit are the current density and the time of deposit, and so a good unit of measure is the ampere minute. If a nickelplater uses 5 amperes per squpare foot and gets a suitable deposit in 35 minutes, he would be using 175 ampere minutes per square foot of surface. Under more favorable conditions, he may be able to use 7 amperes per square foot and 25 minutes only would be needed to get the same deposit.

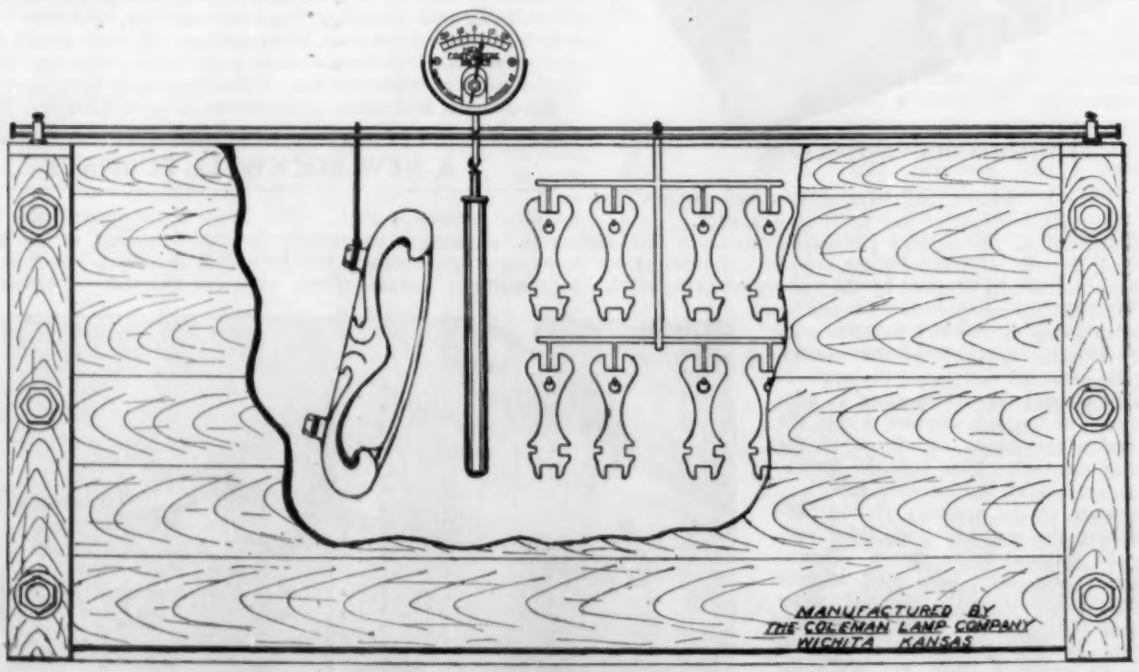
The foot ampere indicator consists of a small ammeter having a suitable mounting device with an electrode of known surface area which is submerged in the solution when the instrument is hung on the tank rod.

The surface area of the electrode is a known part of one square foot, and the current flowing through the electrode passes through the ammeter which is calibrated to give a direct reading in amperes per square foot. Thus the current density at the cathode or anode of a plating vat is fractionally measured.

The instrument is portable and should be hung in different parts of the tank to ascertain if the load has been placed right so that the current flows uniformly through all parts of the work. When the device is hung on the anode rod, the needle will deflect in the opposite direction and give a reading of the current density at the anodes. If this is found to be greater than a reading taken at the cathode, the tank is either overloaded or more anode surface is needed.

Therefore, with this little portable device, the plater can easily maintain the proper relation between anode and cathode surface area, load the tanks with correct amount of work and place it so that the current will flow uniformly, and properly regulate the current density at the cathode.

Knowing the current in amperes per square foot flowing through the cathode, it is easy to determine the time necessary for a suitable deposit, and also know the exact amount of metal that is being deposited, which is important in figuring costs. And last, but not least, regardless of irregularities in shape or size of articles to be plated, the plater can put out load after load of uniform work and deposit a known amount of metal per square foot of the entire surface.



THE HEIL FOOT-AMPERE METER AT WORK.

ASSOCIATIONS AND SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

FOUNDRYMEN'S ANNOUNCEMENT

The Board of Directors of the American Foundrymen's Association, at their annual meeting held in Cleveland on Tuesday, January 13, voted unanimously in favor of holding the 1920 Convention and Exhibit of the Association in Columbus the week of October 4.

This unanimous decision was reached as a result of a careful survey of the accommodations and advantages offered by the various cities which had extended invitations.

The Exhibition buildings on the Ohio State Exposition Grounds afford the most extensive and best accommodations that have ever been provided for the exhibits. In addition, adjoining buildings provide all necessary accommodations for lecture halls and meeting rooms, making possible all the activities of the association in one place.

Bearing in mind difficulties experienced in the past in securing satisfactory hotel accommodations, the Board gave careful consideration to what Columbus could provide and would guarantee, and as a result were satisfied that the Columbus hotels could and would meet all requirements. The week of October 4 was decided upon as a date when ideal weather conditions would most likely prevail.

THE INSTITUTE OF METALS

The two meetings of the Institute of Metals Division held during 1919 were both very successful and well attended. The one in New York in February was very interesting, and the one in Philadelphia in September was also well attended and the papers were of very high grade. The Bureau of Standards presented a number of papers through their representatives, which were equal to any paper that had been presented before the Institute.

Dr. Merica, chairman of the Papers Committee of the Division, is to be congratulated on the quality of the papers he secured during the year. He promises that 1920 will show an equal number of scientific and practical papers.

AMERICAN ELECTROPLATERS' SOCIETY

The December meeting of the New York branch of the American Electroplaters' Society was well attended. President Sterling presided. One applicant was elected to active membership, two new applications were referred to the board of trustees. It has been decided that an afternoon session will be held preceding the banquet, February 21, 1920, for the purpose of reading papers and discussions pertaining to electroplating. The laboratory committee of the New York branch will conduct this session. Papers will be prepared and read by members of the New York branch only.

BANQUET

The 11th Annual Banquet of the New York Branch of the A. E. S. will be held on Saturday evening, February 21, 1920, at the Broadway Central Hotel, Broadway near Fourth street, New York City. Applications for tickets should be made to John J. Burke, 110 Glen street, Brooklyn, N. Y.

PITTSBURGH BRANCH BANQUET

On April 15, 1920, the Pittsburgh branch of the American Electroplaters' Society will be just one year old.

Although this is the baby branch of this educational society from the standpoint of years, it is by no means the smallest.

Realizing that in an interchange of ideas lies co-operation and mutual helpfulness, these hustlers take a zealous interest in fostering the aims and tenets of the society.

In order that those who should be interested in the American Electroplaters' Society may have brought to their attention the merits of this organization, the Pittsburgh branch have decided to observe their first anniversary on Saturday night, April 17, 1920, by a banquet at the Fort Pitt Hotel. Further details will be announced later.

A committee of the truly active members who have been in close touch with the interests of this branch since its inception are in charge of the affair. They are as follows: Abraham Kantrowitz, general chairman; S. E. Hedden, secretary; Wilfred S. McKeon, publicity; Charles J. Rothfuss, menu; Henry A. Beck, music; John Corbit, ex-officio.

ATTLEBORO-PROVIDENCE BANQUET

The third annual banquet of the Providence-Attleboro Branch of the American Electro-Platers' Society, which was held at the Narragansett Hotel, Providence, R. I., on the evening of December 13, was one that will not soon be forgotten by those who were fortunate enough to attend. Nearly 200 members and guests assembled to enjoy the feast of good things that had been arranged by the anniversary committee. The speakers at the after-dinner exercises included Dr. Arthur W. Claflin, who officiated as toastmaster; Floyd T. Taylor, of New York; Theodore B. Pearce, president of the New England Manufacturing Jewelers' and Silversmiths' Association; Charles H. Proctor and M. J. Dowling.

After an informal reception and get-together session in the parlors for nearly an hour, the members and guests, headed by President John Andrews, proceeded to the banquet hall, where an excellent dinner, sans war restrictions, was served.

Following the dinner President Andrews introduced Dr. Arthur W. Claflin, honorary president of the Providence society, as toastmaster. Dr. Claflin congratulated the society on the progress it has made during the three years that it has been in existence and urged every member to secure the membership of every person in the district who was eligible. He also spoke at some length upon the necessity and desirability of the members conducting a campaign of education and publicity so that the manufacturers as well as the public will understand the purposes and principles of the society.

Floyd T. Taylor, consulting engineer, A. P. Munning & Company, of New York, gave a technical address on electric generators that was very interesting and instructive, tracing the history of electricity and the methods employed in its generation and control for commercial and scientific purposes. M. J. Dowling, representing the New York branch of the society, presented the greetings of that association and was given the greetings of the Providence branch to extend to his home body.

Charles H. Proctor, founder of the American Electro-Platers' Society, in his address, said in part: "Mr. Chairman, members and guests of the Providence-Attleboro Branch of the American Electro-Platers' Society: As founder of the American Electro-Platers' Society, it gives me sincere pleasure to be with you this evening and help to celebrate this, the third annual banquet of your branch. Time goes swiftly, as the milestones of years fly by. It hardly seems a year since I had the pleasure of attending your second annual banquet. I am glad to see so many of the old faces with which I am familiar, as well as so many new ones, this evening. I have watched the growth of your branch and can appreciate the interest you have created by your efforts in the city of Providence and the Attleboros, as well as in the surrounding towns, as evidenced by your ever-increasing membership. It proves that the work of your branch is progressive and I sincerely congratulate you all—officers and lay members—for your splendid efforts and the encouraging results in behalf of your adopted profession, the art of electro-plating, gilding and coloring of metals.

"But instead of talking to you tonight along the lines of efficiency in electro-plating, I want to say a few words along the lines of efficiency in co-operation. To every broad-minded, thinking man, whether employer or employee, it

must be conceded that there is something wrong, yes, radically wrong, with our industrial system. The foundation is insecure and unless the chaotic condition we have experienced since the close of the world war is changed we shall awaken some day to find that the false superstructure built upon such a foundation has tumbled over and chaos in the industrial world will result disastrously for all. Surely the man who works for his living either by mental or physical effort must realize that if such a condition should develop he would be the sufferer, because labor cannot live without capital because capital represents the money that purchases the comforts and necessities of everyday life.

"Within the past few months, yes, for a year, we have seen the results of agitation to secure unfair demands, only in the end to prove a costly failure to the man who works for his daily bread. For always in the end the actual producer by physical or mental labor as well as the consumer must pay the price. At the present time we must all see the disastrous results that are daily developing from the actions of the men in one line of industry who through the labor officials demanded a thirty-hour week with unusual demands in increase of wages. If these demands had been conceded, who would pay the price? Who is paying the price at the present time through lack of production of coal, because the miners have gone sullenly back to the mines with the idea that they will not produce upon an efficient basis or even a normal basis? So the people, always the people, must suffer because of an industrial condition that permits any one set of men to disrupt normal conditions at the expense of the greater majority of the others. Such conditions will only change when the United States evolves a law that will govern the working hours equitably in every state of the Union, whether it be a forty or a forty-five hour working week, and enforces the law, and only then shall we reach a firm foundation upon which the workers of the United States can co-operate in production upon an equal basis upon the expenditure of labor.

"Today the dollar has lost a great part of its purchasing value, and why? It is not because of a higher rate of wages than prevailed at pre-war times; it is because of a proportionately lower production under the lower rate previously paid a few years ago. Supply and demand are the great governing factors in the world's trade. If there is no demand in proportion to the supply or only a limited demand, then prices will always prevail accordingly. High prices always follow a limited supply, just prices when the demand and supply are about equal, and extreme low prices when the demand is far below the supply.

"The present high prices are in many instances unjust, unfair and a crime enacted upon the public at large, but just as long as the people will allow such a condition to exist without impartial investigation by those in authority in hamlets, towns, cities or states and also in the United States Government, so long as this nefarious system of robbery at the expense of the consumer will continue.

"The American workman, if he be a true American, must realize that if the high rate of wages now being paid must continue and the high cost of living come down to a fairly equitable basis, he must produce more for his labor. Not in hours but in the energy that he applies to his labor, so that his efforts have a greater producing power in the same time. Only when the law of supply and demand becomes more equalized can we expect any great reduction in the cost of the necessities of life. To you, as Americans, I appeal asking that you do your share to help eliminate the spirit of unrest. To you as votaries in this great nation of ours I appeal to force by your franchise as free men the representatives you send to the nation's capitol, to do the work that you send them there to do, instead of spending all their efforts on political jealousies and political factions.

"If half the effort had been spent by our law makers during the past months in their political quibblings over the Treaty stipulations, in finding out the reasons for the present conditions and developing ways and means to combat them, we should have accomplished much to bring about more satisfactory and fair conditions. Surely as a great nation we must have become a sorry spectacle to the smaller nations, who have previously always thought of us as the Great Free American Nation to which their eyes have looked longingly. Why could we have not signed the Treaty and then let Destiny have been our 'guiding star?' We are a great nation, great enough to take care of ourselves under any circumstances, so what is there to be afraid of?

"Now having taken up so much of your valuable time, I plead for a closer co-operation, however, between you as employers and your employees for in the forward industrial movement that must surely come. It must be on the basis of co-operation so that we can always be the first in rank with our manufactured products. Capital and labor must co-operate in close unison, the spirit of unrest must cease and agitation in all its forms must end. The great industrial concerns throughout our country must share a proportion of their profits and labor must in return share its brains and physical energy in a greater production to meet the present unequal condition between supply and demand. Harmony must eventually prevail between capital and labor upon the basis of a closer and more legitimate co-operation.

"We are all ruled by self-interest. In all the world there is not and there never has been such a thing as unselfishness. Now if the men and women, who are the producers in the field of labor, can be shown that it is to their selfish interest to co-operate to the fullest extent and if they do so co-operate, the results will be a greater production in the future as compared with present production.

"If men and women can be brought to an intelligent understanding that a greater production will eventually lower the cost of living, at the same rate of wages, then a vital issue will have been solved. We are all American in this hour of agitation and unrest—let us prove it, and to do this let us take as our motto—'One for all, all for one,' and there need be no fears or doubts as to the result."

Theodore B. Pierce, president of the New England Manufacturing Jewelers' and Silversmiths' Association, in responding to the introduction that the Electro-platers' Society felt complimented by his presence said in part that he also felt complimented by the Society's invitation and that after listening to the speakers who had preceded him, he felt that appreciation of the work that the Electro-Platers' Association is doing in promoting the efficiency of its members and said that he believed the general efficiency of the coloring and electro-plating branches of the jewelry industry were materially benefited by their efforts and discussions.

NATIONAL ASSOCIATION OF BRASS MANUFACTURERS

In starting upon the new year everything seems favorable to a growing business and an enlarged consumption of goods in the brass line. Labor is scarce and efficient workmen very hard to get. Metals are stable—copper around 19¼c., with lead at 8c. and an upward tendency. There is a general indication upon the part of all manufacturers to safeguard themselves by accepting orders and pricing them at the current market price at the time shipment is made. This is more or less necessary, as orders are generally accepted to ship at the earliest convenient moment, and as almost all brass plants are now from four to five months behind on orders, unless something of a special nature or urgent character comes to hand, immediate shipment as in days of old is quite impossible.

The process of elimination adopted by the National Association of Brass Manufacturers will be of material assistance alike to the manufacturer and to the jobber. Something over twelve thousand items, in different sizes, kinds, colors, types, threads and finishes, have been eliminated and will not be made or carried in stock in the future. This releases a large amount of material, composed of labor and metals, in a partial state of manufacture which has been held in the bins and which of necessity had to be paid for in some way.

The same matter will be followed by a great accumulation of obsolete or quasi-obsolete goods that move slowly and have been on the jobbers' shelves, requiring room and capital invested to carry, all of which it is hoped will be saved by the more modern method of manufacturing, handling and merchandising this line of goods.

NATIONAL MACHINE TOOL BUILDERS

1919 was a year following the war, during which the association had played its part. The conventions held during that year were largely of an educational nature, in which the industry tried to study and meet the post-war conditions. Its constant endeavor is now to serve the needs of the country in every way possible in the time of peace.

FOUNDRY EQUIPMENT MANUFACTURERS

The Foundry Equipment Manufacturers' Association, organized about a year ago to promote and further the interests of its members by impressing upon foundrymen generally the advantages to be derived from the use of efficient foundry equipment, proposes now to broaden the scope of its activities by conducting a campaign of education on the proper care, maintenance and operation of such equipment after it has been installed.

The members of this association, with their comprehensive knowledge and experience of conditions and problems in all classes of foundries, have been in a particularly favorable position to accumulate facts and data on the subject. They now propose to embody this information in a series of monthly bulletins, to be issued during the coming year.

These bulletins will be sent direct to the executives, superintendents and foremen of all the foundries in the United States and Canada.

That they may receive the attention of the men interested, they will be mailed to their home addresses. An adjustable, stiff cardboard cover will be sent with the first of the series so that the bulletins may be filed as they are received and thus be available for reference. The cover will be of convenient pocket size.

Only one individual phase of the problem connected with each piece of foundry equipment will be considered in each of these bulletins. It is stated that they will be written in a concise, practical manner and will contain a wealth of pertinent hints on the most efficient method of caring for and operating mechanical equipment to secure maximum production and service. The members of the association follow:

American Clay Machinery Company, Bucyrus, O.; American Foundry Equipment Company, 52 Vanderbilt avenue, New York City; American Molding Machine Company, Terre Haute, Ind.; Arcade Manufacturing Company, Freeport, Ill.; Berkshire Manufacturing Company, Whitney Power Block, Cleveland, O.; Beryk Company, 1265 West Second street, Cleveland, O.; Blystone Manufacturing Company, Cambridge Springs, Pa.; Buch Foundry Equipment Company, York, Pa.; Cleveland-Osborn Manufacturing Company, 5401 Hamilton avenue, Cleveland, O.; Federal Foundry Supply Company, 2639 East Seventy-ninth street, Cleveland, O.; Foundry Equipment Company, 1831 Columbus road, Cleveland, O.; Grimes Molding Machine Company, 1218 Hastings street, Detroit, Mich.; Hanna Engineering Works, 1759 Elston avenue, Chicago, Ill.; H. M. Lane Company, Detroit, Mich.; McLain-Carter Furnace Company, Milwaukee, Wis.; National Engineering Company, 549 West Washington street, Chicago, Ill.; S. Obermayer Company, Eighteenth and Rockwell streets, Chicago, Ill.; Pangborn Corporation, Hagerstown, Md.; J. W. Paxson, Philadelphia, Pa.; Henry E. Pridmore Company, Nineteenth and Rockwell streets, Chicago, Ill.; P. H. & F. M. Roots Company, Connersville, Ind.; U. S. Molding Machine Company, 968 East Sixty-ninth Place, Cleveland, O.; Wadsworth Core Machine & Equipment Company, Akron, O.; Whiting Foundry Equipment Company, Harvey, Ill.; E. J. Woodison Company, Detroit, Mich.; Young Bros. Company, Detroit, Mich.

THE ELECTRIC FURNACE ASSOCIATION

The Electric Furnace Association was not launched until well along in 1919, the first formal meeting being held in New York in April. A constitution was adopted and officers elected to serve until a permanent organization was created at a meeting in Chicago the latter part of September.

One of the chief aims of the Electric Furnace Association is to bring out the truth in regard to the electric furnace and its products. We plan, for instance, to obtain results of tests and all possible substantiated figures on the actual quality of electric steel, electric brass, etc., and to issue this for the information of buyers and the public. The work of compiling this information is being continued and another such booklet will shortly be issued. In case we are not able to obtain sufficient information in regard to brass and other products of the electric furnace in time for use in this second edition, we expect to cover these non-ferrous fields in a later issue.

Another aim is to provide, through the association, a forum for the discussion of problems of the electric furnace. For instance, at the April meeting of the Electrochemical Society to be held in Boston, there will be a symposium on power for the electric furnaces and electrochemical industries. The association is giving its full co-operation in an effort to make this most successful. We are endeavoring to secure papers and discussions which will present the power problem from three different points of view: that of the furnace operator, that of the power company or power sales company, and that of the furnace maker.

While most of our meetings to date have been held in conjunction with meetings of the American Electrochemical Society, we contemplate similar co-operation with many other societies of this kind. Our plans are already quite definitely shaped for a discussion on some subject of common interest at the time the National Electric Light Association meets in Pasadena. We are also discussing similar arrangements with a number of other societies who, we are glad to say, welcome the idea of co-operative meetings with a society representing such an important industry.

The present officers are:

Acheson Smith, Niagara Falls, N. Y., president; C. H. Booth, 326 W. Madison street, Chicago, Ill., vice-president; W. E. Moore, Union Bank building, Pittsburgh, Pa., vice-president; C. G. Schluederberg, Box 911, Pittsburgh, Pa., secretary; F. J. Ryan, Franklin Trust building, Philadelphia, Pa., treasurer.

The directors are the officers named above and F. J. Tone, Niagara Falls, N. Y.; C. A. Winder, Schenectady, N. Y.; H. G. Weidenthal, Cleveland, Ohio; A. T. Hinkley, Niagara Falls, N. Y. Harry P. Martin, Niagara Falls, N. Y., assistant secretary.

PERSONALS

ITEMS OF INDIVIDUAL INTEREST

Alphons L. Orschell has resigned as brass foundry superintendent of The Lunkenheimer Company, Cincinnati, O., and is now associated with The Hill & Griffith Company, Cincinnati.

H. M. Richmond, manager of the plant of the **Aluminum Castings Company,** Fairfield, Conn., has been promoted to the position of factory manager of all Aluminum Castings plants in the east.

Nelson B. Gatch has been appointed by the **Chicago Pneumatic Tool Company,** Chicago, Ill., district manager of sales, succeeding L. C. Sprague. Mr. Gatch will have his headquarters at 52 Vanderbilt avenue, New York City.

Richard Zilberman, proprietor of the Schenectady Polishing anl Plating Works, Schenectady, N. Y., has purchased the entire polishing and plating equipment of the Troy Foundry and Machine Company, Inc., of Troy, N. Y., which he will install in his own plant.

Edward J. Doyle has resigned his position as superintendent of the Wisconsin Motor Manufacturing Company, of Milwaukee, Wis., to accept a similar position with the Waukesha Foundry Company of Waukesha, Wis., who will enlarge their plant by another brass foundry, 250x78 as soon as the ground can be broken.

DEATHS

James Clarke, manager, Clarke Brass Foundry, Kansas City, Mo., died at his home in that city on December 26.

Two of the foremost figures in the copper-producing world died during the first week of January, 1920. **James McLean,** vice-president of the Phelps-Dodge Corporation, New York City, and **Edward Brush,** vice-president of the American Smelting and Refining Company, New York City.

John Young, one of the pioneers of the plating industry, died on December 3, 1919. He had had full charge of the plating department for Simon Zinn, Inc., New York, for forty years. Under the group insurance plan of this company, Mr. Young's widow received $3,000 from the insurance company and a sum almost as large from Simon Zinn., Inc.

Ezra Fred Wood, a director and also consulting engineer of the International Nickel Company, 43 Exchange place, New York, died suddenly of heart disease in the subway January 5. He was 61 years old. Until two years ago, he was first vice-president of the International Nickel Company, which he assisted to organize in 1902 at the time he left the Carnegie Steel Company. He was graduated from the University of Michigan and was with the Carnegie company for twenty years. He was a recognized authority on metallurgy. He had on his person at the time of death a passport for visiting China and the Far East for pleasure and health.

As we go to press, word comes to us of the death of **W. Symonds,** foreman of Plating Departments of the Lamson Consolidated Store Service Company, Lowell, Massachusetts.

Mr Symonds passed away January 12, after a short illness, and leaves a widow and three children.

Mr. Symonds was a member of the Electro Platers' Association and attended many of the conventions held, usually exhibiting samples of unusual work, and was generally well known among the fraternity. He had been in charge of the Plating Department for about fifteen years, and was a man held in unusually high esteem for his fine character as well as for his ability.

TRADE NEWS

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

WATERBURY, CONN.

JANUARY 19, 1920.

The first of the year saw the opening of the new home of the Chase companies' offices on Grand street. For many years, the efficiency of the three companies—the Waterbury Mfg Company, the Chase Metal Works and the Chase Rolling Mills—under the Chase interests has been hampered from the fact that they were widely separated from each other, the Chase Metal Works being in Waterville while the two other companies are on North Main street, Waterbury.

Now the offices of these three companies are in the stately new building but recently completed, and one of the most beautiful buildings in the city. It is designed by Cass Gilbert and its estimated cost is $1,000,000. It is of gray stone and has a frontage on Grand street of one entire block. Aside from the offices for the officials and clerks of the different companies, there is a large reception hall attractively furnished and a rest room.

One of the unusual features of the new establishment which attracted some comment at the time was the landscape gardening about the building. Several full grown trees were transplanted bodily to the office yard and various bushes and shrubs so that although the outside of the building was finished only last spring, the yard was in full growth by fall with no indication of recent building operations.

The whole place is surrounded by an attractively painted iron fence with the name "Chase Companies" engraved on the gate.

THE NEW HOME OF THE OFFICES OF THE CHASE COMPANIES, WATERBURY, CONN.

The brass manufacturing interests of Waterbury faces in 1920 in an unusually prosperous year as compared to other industries of the country. Nearly all of the factories in Waterbury itself and in its suburbs manufacture necessary, staple articles little affected by fluctuating public demand. Before the war, they manufactured all sorts of brass parts, brass novelties, beside pins, buckles, and watches and were prosperous. The war came and they easily adapted their machinery and force to the output of shells, munitions, and were, for the time a little more prosperous. The end of the war came, and they went back to producing pins and brass parts again, and were a little less

prosperous but still in a healthy, normal condition while other factories which had been devoted solely to the output of ammunition and other war products found themselves suffering under great losses due to the cancellation of war contracts.

Labor troubles in Waterbury last June, when some 6,000 laborers were on a strike from six of the largest factories in the city demanding shorter working hours and more pay have left little if any mark on the industry in the factories. The trouble was short lived, all of the workers having returned to work but one month after the strike began, on a satisfactory basis of adjustment.

The number of men employed in the different factories has of course decreased largely since the war. As every factory in the city did war work a large floating population came in from other cities attracted by war time wages. The factories in the city are now back to their normal pay roll. The Scovill Mfg. Co., the largest factory in the city, however, has nearly twice as many permanent employees as before the war. The number increased from 3,500 in 1914 to 15,000 at the height of the war, and is now 7,000.

An employee of the Farrell Foundry Co., here, Quirino V. Distefano, has succeeded in having his invention of a submarine-airship patented. The patent hung fire for a long while since there was a controversy with English authorities who claimed that it was an infringement on the patent of their patent on the submarine. It was only recently decided in favor of the local disputant.

The Bristol Brass Co. has increased its capital stock to $1,000,000 to capitalize its indebtedness on recent industrial expansion.

No factories here were affected by the drastic fuel restrictions of early December since they decided not to curtail their coal consumption until they received official notice. This did not come before the rescinding order was given out.—B. H. P.

BRIDGEPORT, CONN.

JANUARY 19, 1920.

Industrial Bridgeport has made a remarkable bounce during the past year in adjusting itself from war to normal peace work. But the bounce was not accomplished in a day, or a month, or without inconveniences, and even financial losses and decrease of population. The adjustment has been severe in spots, but at the close of the year of 1919, Bridgeport was in far better shape, industrially, than at any time before the war.

The city's inflated population is no longer a problem, as thousands of workmen and their families have left the city, and the deflation was accomplished about the middle of the year. The big Remington gun plant, which employed at one time something in the neighborhood of 14,000 hands, is now silent and empty, and today this big plant, which cost upwards of $6,000,000, with equipment, has a sign on it "For Sale." Its army of workers have departed to where they came from. Although the demobilization of the army of workers was gradual, and began during the holidays a year ago, war contracts kept many employed there till July.

There was the same gradual let up in war work at the Union Metallic Cartridge Company, where the working force has been reduced from 14,000 to 4,000, the normal number of employes in peace time. In this plant there is a loss of 10,000 hands to the payroll. In this instance there were many women employes, who during the war dropped their household duties for the higher duties of country. They have gone back to their homes, so the deduction in the number of employes here does not mean that they have all left the city. Again, a great many of the discharged help have gone back to farm work in the suburban territory nearby.

The government dismantled the Liberty Ordnance plant about the middle of July, and also the Bullard Engineering Works about the same time. The former made projectiles and other munitions of war, and the latter guns for the artillery arm of the army. Perhaps the two concerns employed about 1,500, and there, too, the demobilization of the forces was gradual.

Between February and July of last year withdrawals from the banks were heavy. By July the withdrawals from the savings banks alone was a little over $4,000,000 by workmen who had been discharged and were leaving the city. The surrender and sale of Liberty bonds by workmen leaving the city, or waiting for a job, was also large, but no estimate has ever been made of the amount in the brokerage offices or banks.

Of the 185 industrial plants in the city, 57 of them were doing direct war work with the government, such as the concerns above mentioned, and 78 indirect war work, much of which was sub-contract work from the big shops. In all, 135 out of the 185 shops in the city were doing nothing else but government work, or part government work.

There was a good deal of idleness during the spring and midsummer of 1919, due to the slowing down of government work, and the idleness was somewhat accentuated by the daily coming home of Bridgeport men discharged from the service, and who asked for, and as a rule received, their old jobs back.

A strike at the Columbia Graphophone plant in mid-summer added to the industrial distress, but that was overcome after a threat from the company that they would move the plant out of the city, and after Mayor C. B. Wilson took an active part in the strike and brought such pressure on one of the labor agitators as to force him from the city for a time.

The Bullard Machine Tool Company is another instance of a successful bounce back to peace conditions. It never employed more than 1,000 before the war, and, in fact, in 1914 its payroll contained less than 250 names. War contracts swelled the number of employes here tremendously. The government built for this concern a large gun factory in the west end of the city. The company recently purchased the property from the government. It now employs about 1,700, which is a wide difference from 250 in 1914.

Other concerns that are above normal in peace work may include the Bryant Electric Company, which may soon put on a night shift; the Raybestos Company; the American Tube and Stamping Company, the American Chain Company, the Warner Bros. Corset Company and a few other lesser concerns. Both the Salt's Textile Company, the International Textile Company and the Porcupine Company are planning to expand.

The Locomobile Company of America has just passed under the control of the group who control the Mercer Car Company, and the new name of the local plant is the Locomobile Company. No information has yet come from the local office as regards its future, but information from the New York office is to the effect that the same grade of car and truck will be maintained, besides a cheaper type of car than the Locomobile, which would mean that the company will be busier under the new management and control than under the old.

Before the war the figures from the office of the local Manufacturers' Association show that the local factories employed on an average 36,000. There was no attempt at monthly tabulation of the number of workers here during the war. The constant changes made that thing impracticable, but at one time the figures showed 63,000.

The December figures of employes in local factories show 43,000, a figure that tells at a glance how successfully Bridgeport readjusted her industrial activities from war to peace conditions and in the readjustment made a clear gain.

There has been no labor disturbance since last summer. There have been some minor differences of a factory character, arising over differences in method of awards, but aside from those ripples the labor situation has not been so satisfactory since 1914.

NEW BRITAIN, CONN.

JANUARY 19, 1920.

The big manufacturing concerns of New Britain passed through several phases of development during the past year in which they ran the entire course of the depressions at the beginning of 1919, following the let-up in war industries due to the signing of the armistice, to the present day prosperity in which they are all operating to the fullest extent and working hard to bring about the completion of new additions which are to aid in handling the wealth of new business on hand. When the armistice was signed many war contracts were cancelled and naturally this was reflected in the work and in the number of men employed. However, the depression at no time reached serious proportions here. In the late spring and early summer, however, a new stimulus was felt. As factories became ad-

justed to peace time conditions, their business began to pick up. Orders began to pour in. South American and other foreign fields were explored by enterprising sales departments. New products were taken from the shelves and perfected, and by the last of the summer and early fall every single local concern was operating with full forces. Drawing aside the mythical curtain of 1920, local captains of industry declare that they see an era of heretofore unbelievable activities. They look to see all records broken for production in all lines of industry. Labor trouble is at a minimum and production is at full blast. This, with satisfactory wages, augurs well for the coming twelve months. The close of 1919 saw the city's most important ex-war factories hustling to catch up on a mountain-like pile of old orders for builders' hardware, cutlery, electrical household appliances, machinery, castings, novelties and countless other metal articles turned out in this city.

Without doubt, the greatest single item in the expansion of the city's factory interests at present is the new building now under way for the Landers, Frary & Clark company. It will cost a quarter of a million dollars. Other important additions nearing completion include the new brass foundry of the P. & F. Corbin branch of the American Hardware corporation, and the just completed factory addition of the Corbin Cabinet Lock Company of the same corporation. While every concern has grown enormously during the past few years, probably the two which, from the viewpoint of spectacular figures should claim the most attention are the New Britain Machine Company and the Fafnir Bearing Company. A decade ago the Fafnir Bearing Company employed between 10 and 15 men. Today its payroll includes more than 650. No less astounding has been the growth of the New Britain Machine company from a small wooden factory employing 385 hands in 1910 to a monster concern with 1,403 employes today. Others of the older concerns have also developed greatly during the decade, notably the Stanley Works.

Thus, there is every reason to believe that New Britain factories, having more than done their "bit" during the war, having successfully weathered the slump immediately following the cessation of hostilities, now stand on the threshhold of a new era of business activity, which will undoubtedly be the greatest that the industrial world, in so far as it affects this immediate locality, has ever experienced.—H. R. J.

TORRINGTON, CONN.

JANUARY 19, 1920.

Difficulties in securing deliveries of raw materials and finished products in large quantities are among the principal handicaps against which manufacturers are working today. Labor conditions in Torrington are normal. Three of the factories are working nights to 9 o'clocks and certain departments in one or two are working all night. There is sufficient fuel on hand to last at least two months. Big additions are being erected to the Torrington Manufacturing Company's and the Standard plants and additions to other plants are being contemplated. The year 1919 from the viewpoint of building operations and general expansion was a most satisfactory year and the prospects for continued expansion in the present year are bright.

The Torrington Company is to build a big new administration building in the spring to house the offices of its four plants in Torrington. The new building will be on Field street to the north of the Excelsior Needle plant. It will probably be of red brick construction. Plans are now being drawn. At present the offices of the Excelsior, Standard, Progressive and National Sweeper plants are located in separate buildings. Work is progressing rapidly on the erection of the big addition to the Standard plant of the Torrington Company.

The proposition to construct a barge canal at the lower end of the Naugatuck Valley has been unfavorably reported in Congress, according to official notification received here.

Another demurrer to the complaint was argued in the Superior Court for this county last month in the case of Ida C. Prince against the American Brass Company. An injunction and $50,000 damages are asked for the defendant company's alleged trespass on property of the plaintiff in Torrington.

Dr. W. E. Hoffman, who has been in charge of the first aid department at the Coe Brass Branch of the American Brass Company for several years, has resigned and will begin the practice of medicine here. Dr. Hoffman was for two years in service in the army medical corps.

Announcement has been made of a gift by John F. Alvord, of the Torrington Company, of $25,000 for the nucleus of a building fund for St. Francis R. C. Church.

Major A. F. Brooker, former superintendent of the Coe Brass plant, who died in December, left an estate of over $262,000, according to the inventory filed in the probate office. The entire estate was left to his daughter, Mrs. A. C. Thompson.

Harry C. Foss of the sales department of the American Brass Company at Waterbury has been seriously ill with nervous prostration. Mr. Foss was for a number of years a resident of Torrington and was employed at the office of the Coe Brass Branch.

David A. Sullivan will leave this month to take charge of one of the Torrington Company's plants in Europe.

The annual meeting of the Manufacturers' Association of Connecticut was held in December in New Haven. E. Kent Hubbard of Middletown was re-elected president. Other officers are: Vice-president, John H. Goss of Waterbury; secretary-treasurer, Robert C. Buell of Hartford; executive committee, F. J. Kingsbury of New Haven, I. M. Ullman of New Haven, Charles T. Treadway of Bristol and E. A. Moore of New Britain. All these were re-elections with the exception of Mr. Moore who was chosen to succeed Clarence E. Whitney of Hartford, who declined another term. Mr. Whitney was unanimously elected an honorary member of the executive committee for 1920. Four directors were elected to serve three years as follows: At large, J. E. Otterson of New Britain and Charles Cook of Hartford; to represent New Haven county, L. J. Hart of Waterbury; Fairfield county, William Hobbs of Bridgeport. The meeting was attended by more than 200 manufacturers from all parts of the state.—J. H. T.

HARTFORD, CONN.

JANUARY 19, 1920.

Industrial developments in Hartford since the ending of the war have come something as a surprise, in that the depression following the armistice was short lived. The rapid expansion of Hartford factories during the last few years, with arrangements by many concerns for new and larger buildings, providing labor for thousands of more workmen bids fair to increase.

Upon the canceling of war contracts, and within three months of the war's end, Hartford's industries were at a low ebb. Employes had been discharged by the thousands, and the outlook seemed dubious. From this point, however, advance was rapid, with a prosperity far more healthy than that enjoyed on a war order basis. The demand for labor far exceeds the supply today. Manufacturers believe that this city is on the eve of by far the greatest industrial expansion in its history. Increase in building by manufacturers due to war orders was at first regarded as a temporary boom, but that increase, as great as it was, is trivial in comparison with the expansion program of Hartford factories based on the orders of peace.

Thomas J. Kelley, manager of the Manufacturers' Association of Hartford county, has stated that at the present time Hartford manufacturers are badly in need of employees.

Expansion programs have been foretold, also, for the Underwood and Royal Typewriter companies plants, and the Colt's Patent Fire Arms Manufacturing Company. The indications are that by next fall these three will have furnished employment to between 2,600 and 3,200 persons. Pratt & Whitney's, the Hanson-Whitney Machine Company, the Billings & Spencer Company, the New Departure Company, the Jewell Belting Company and the Whitlock Coil Pipe Company have signified their intention of increasing their working forces.

The prosperity in manufacturing lines is confronted with a serious obstacle. The question is: How are 10,000 additional workers to be housed? Unless something is done to solve the housing problem, Hartford's industrial expansion will be jeopardized. Efforts are being made to benefit the situation, but it is conceded that it is serious, and has been serious for some time.

From 1914 to 1920, Hartford's industrial population grew from 20,066 to 30,000, and with the added factory expansion for which provision has been made this year, it is estimated that the industrial population of this city will be increased to 40,000 during this year and next.

The capital in Hartford industries was increased from $53,791,000 in 1914 to $100,000,000 in 1919-1920, and the yearly factory payroll jumped from $14,662,000 to $45,000,000. The value of factory products in 1914 was $42,737,000, while in 1919-1920 the estimates show a value of $100,000,000, an increase of more than 100 per cent.—W. A. L.

ROME, N. Y.

JANUARY, 19, 1920.

Business in the metal trades line here is very good. The shops are working at top speed and in some cases night shifts are being operated. Everything points to an unusually busy and successful year for 1920. Rome plants are expanding their field of industrial activity.

Negotiations, which have been underway for some time, have culminated in the purchase by the Rome Wire Company of the insulated wire business heretofore conducted as a department of the B. F. Goodrich Company of Akron, Ohio. Under the well known name "Diamond," the Goodrich Company has built up a successful and growing business in rubber insulated wires and cables which the Rome Wire Company will maintain and improve, in keeping with the well merited reputation of the local concern.

The growing demand for the other products of the Goodrich Company, it is understood, made it advisable to give their undivided attention to those products, and so the decision was made to sell the business and equipment of the wire and cable department to the Rome Wire Company, knowing that it will be operated in such manner as to assure the customers of the Goodrich Company a continued source of supply which will amply care for their needs.

As the Rome Wire Company operates extensive rod, wire drawing and insulating mills, negotiations were started with the local concern and final details arranged in this city. The Goodrich Company was represented by F. C. Van Cleef, secretary, Manager of Sales of the Insulated Wire Department Thomas L. Barnes. It is the intention of the Rome Wire Company to operate the wire business purchased from the Goodrich Company as a separate department of its own business. This new branch of the Rome Wire Company will probably be located in either Buffalo or Chicago, in order best to serve the demands of the trade. M. J. D.

ROCHESTER, N. Y.

JANUARY 19, 1920.

The year that is about to close has been the most successful and busiest in the industrial history of this city The volume of manufactured products has been beyond conception, despite a certain percentage of labor disturbances. All of the larger industries have been operating at top speed since the beginning of 1919, the only drawback experienced being the inferior rail and express facilities. However, after discounting the effect of poor rail service, the output of manufactured products has been tremendous.

Superintendents of the larger plants are unanimous in predicting a still more prosperous season in 1920. Orders continue to come in from all sides and in generous sizes. The volume of manufacturing at the Eastman Kodak Works, the Bausch & Lomb Optical Works, the several can concerns, the General Railway Signal Company, the Pfaudler Company, and the automobile industries, have expanded beyond expectation. The immense Eastman plants are constantly receiving additional buildings in order to keep pace with the increased demand.

Rochester manufacturers expressed unconcealed satisfaction at the announcement from Washington to the effect that the railroads would be returned to their owners on March 1. This action on the part of the government was not unexpected, however, but Rochesterians had been led to believe that the roads would be turned back to their owners on January 1. With the roads out of governmental hands, the disappearance of red tape and political shiftlessness will disappear, to the immediate benefit of the railroad systems and business in general. Manufacturers anticipate an adjustment of conditions so soon as the roads are turned back, a new schedule of freight rates will result, better shipping directions and deliveries all around.

The coming year will witness an increased invasion of South America and Eastern Asia by Rochester-made products. When the recent world war broke out, Rochester manufacturers were beginning to create a market for local products in every state in South America. Brazil, Chile, Argentina, and Uruguay in particular had shown great interest in much material manufactured in this city. With the final settlement of peace and the restoration of international commerce to normal conditions, the South American trade is bound to be a valuable asset to many local industries.

Copper is firmer in Rochester, and quotable at 19c. The metal is obtainable in plenty, subject to delay in shipment by rail. Brass is also in sharp demand and obtainable from the mills, subject, however, to a delay of three months. Brass rods were quoted today in Rochester at 22c. and brass sheets at 23½c. The market for lead, of course, is but a reflection of that of the larger cities. Lead is in strong demand and quotable at 8c. The tin market is normal, and the demand strong. Because of the shortage of stocks at all shipping points the local market is very close. Users anticipate easier conditions after the new year. All mills receive orders subject to delay. The demand for zinc is good and prices unchanged. The aluminum situation, it is declared, is growing worse every day. Labor conditions and poor rail deliveries are blamed for this state of affairs in Rochester. The demand upon the mills is enormous, yet in spite of these things the price of aluminum in Rochester has not varied in several months.

The General Electric Company has acquired the several Symington war munition plants in Rochester, and it is said the company proposes to develop a branch industry in this city.—G. B. E.

WORCESTER, MASS.

JANUARY, 19, 1920.

Industrial Worcester prospered in 1919. Leaders in the city's industries believe 1920 will be equally as prosperous. The prosperity which the city experienced in the past year is reflected in several different ways. Worcester's industries are now on the rush, a rush something like the one they experienced after the war had been started a few months. The rush seems to be confined to no one particular line of business; all factories are busy. Some are working night and day. The wire and steel industry, the city's principal one, is as rushed as any of the others, if not more so.

In spite of considerable labor trouble in the past year, the output of the Worcester manufacturing establishment has been far above normal and statistics show that the number of failures have been far less than in any previous year.

The strike of iron molders in the city, which lasted over a period of several months, was the principal setback of most of the metal industries in the city during the year, but that is now passed and so adjusted that additional trouble from the quarter of the molders is not expected.

Industrial experts of the city estimate that the payroll of industries of the city for the past year is in excess of $2,237,000 weekly, or, in other words, the working people during the year have received approximately $123,240,000, and the figure is considered conservative. It is based upon the minimum number of workers rather than the maximum, or even the average, and it is figured on the basis of what is considered an average minimum wage.

The Vulcan Foundry Co. of Worcester has been organized in Worcester by business interests not desirous at this time of disclosing their identities. The corporation has been formed under laws of Massachusetts with a capital stock of $10,000, and

a location for its place of business is said to have been secured on Hermon Street in this city. R. Nelson Molt, of Millbury, is president just now; Samuel G. Nash, treasurer, and Samuel Seder, clerk. They are to resign in a week or two, when permanent officers are to be elected. The charter provides for a brass and iron foundry.

The city has been chosen as the most promising looking manufacturing center by the Ionite Storage Battery Co., which has just bought a large shop on Park Avenue and is now manufacturing the batteries on a much smaller scale than it will later. The company is now filling a single order calling for 5,000 batteries. The battery is a Worcester invention. Albert H. Williams is president of the new company, Rayworth W. Burnham treasurer and Howard W. Cowee, a lawyer, clerk. Mr. Williams is a chemist and expert on battery construction. The battery differs from others in that it is made from solid plates, and is guaranteed a longer life than most of the others.

Worcester led all New England cities, including Boston, in the number of permits issued for new construction for the ten months of the year from Jan. 1 to Nov. 1, the total number of permits issued in that period in the city being 1,249. Boston was second with 1,088, and New Haven third with 960. Springfield followed New Haven with 860 and Hartford was next with 707.

The molders' strike, which worried Worcester manufacturers for a long time, is practically over with. Practically all the larger foundries are now running as before the strike. Settlements in some cases which were not made public have been made and things seem to be going on agreeably for the employe and the employer. The strike cases were taken into the courts, but little satisfaction was gained by either side in this end of the controversy. For the greater part, the court actions had to do with picketing by the union men.

Osgood Bradley Car Co., which has one of the biggest manufacturing plants in the city and which annually uses tons of steel and iron and tons of copper and brass trimmings is now booming. The company is making bodies for the Standard 8 automobile as well as its usual line of trolley and steam line cars. In addition, the trolley car business has been greatly boomed through the fact that the company has designed, and is now building, the latest type of one-man trolley car, which is being used in many of the eastern cities by companies that wish to cut to a minimum the cost of operation. The company is now working on an order for 165 of this type of car.

Much is being done by Worcester manufacturers in the matter of Americanizing many of Worcester's citizens. The American Steel & Wire Co., Clinton-Wright Wire Co., and Spencer Wire Co., as well as the Norton Co., and several other of the large Worcester companies, have directed the starting of Americanization classes which are being attended by large numbers of foreigners in their employ.

W. J. B.

DETROIT, MICH.

JANUARY 19, 1920.

The metal industry of Detroit enters the new year with prospects of greater production than ever before in its history. The automobile plants, which are undergoing such wonderful expansion, are carrying with them the brass, copper, aluminum and gray iron concerns. Notwithstanding the high cost of everything, new construction among the automobile companies seems almost inconceivable. The General Motors Corporation has well under way the erection of a twenty-story executive building on the West Grand Boulevard covering a whole city block, that will cost about $10,000,000. It will not be completed and occupied until sometime next fall. The Maxwell Motor Corporation is expending several million dollars for new buildings on its site on Oakland avenue. The Ford Motor Company has recently completed an addition to the Highland Park plant and has another structure well under way that will aid materially in increasing its production. Concentration of effort and increased production seems to be the plan of every great concern in the city and suburbs.

Henry Ford and his son are now the sole owners of the great plant in Highland Park. Mayor Couzens, within the last few weeks, sold his stock to the Ford interests for several million dollars, completing a transaction that was started a year or more ago. Just before the end of the year the Ford interests began distributing substantial cash bonuses to all employes of six months' service or over. An opportunity to purchase stock on the easy payment plan also is one of the Fords' new features. It might be well to add here that Henry Ford and his son now employ upwards of 90,000 men in their Highland Park and River Rough plants.

It is going to be more difficulty than ever to get a new standard make automobile within the next twelve months. The companies simply cannot produce fast enough to meet the demands. When it is realized that every automobile, truck and tractor requires more or less brass and grey iron, some idea may be gained of the enormous quantity of these metals that goes into automobile production here. There are few brass, copper and aluminum plants in the city that do not do more or less work for the automobile companies, not only in Detroit, but in the suburbs as well.

The labor situation never was better than it is today. No strikes are threatening, although Detroit is said to be one of the centers of radical agitators. A strong police control and good wages have the labor situation well in hand here.

Most everybody is anxiously waiting the result of the census taking which is now well under way. It will tell the story of the metal industry in Detroit as never before. It is predicted that Detroit proper will considerably pass the 1,000,000 mark, while Highland Park, wherein is located the great Ford plant, will exceed 40,000. Hamtramck, in which is located a number of grey iron plants and the great automobile plant of Dodge Brothers, will show a population of fully 30,000.

PHILADELPHIA, PA.

JANUARY 19, 1920.

The year 1920 opens with excellent prospects for the metal industries of Philadelphia. With the settlement of the coal and steel strikes, business here as elsewhere is on a better basis than it has been for some months. The enormous demands of the country for reconstruction materials of all kinds and the heavy building construction programs planned for this year insure for all local plants a good business year. Inquiries are coming in faster with each week, and the amount of work now on hand in the majority of plants is almost enough to keep them operating at capacity.

Labor is more settled at present than it has been during the latter months of 1919, although it is a gratifying fact that labor in this district has been more steady and free from disturbance than in most large industrial centers of the country. This has always been true of Philadelphia, and is a big factor in inducing new industries of all kinds to settle here. This city's importance as a center of industry and distribution for the eastern Atlantic states is acknowledged by the decision of a concern of the size of Sears, Roebuck & Company in establishing a new branch here. Their contractors are now at work on a building to cost $8,000,000 on a 40-acre site in the northern section of the city.

The amount of building permits recently taken out for new work this year has been the heaviest on record. One of the largest is a permit for $2,500,000 for a new power house for the Philadelphia Electric Company. The electrical equipment is expected to cost a like amount. The building will be reinforced concrete and steel, 197 by 130 feet, located at Beach and Palmer streets. This new project by the Electric Company is an evidence of the growing power requirements of Philadelphia's industries and population.

One of the typical large industries of the city is the Baldwin Locomotive Works, which last month was working at about 75 per cent capacity, with approximately 15,000 employes at work. Domestic buying of locomotives on a large scale is expected to be resumed with the return of the railroads to private operation on March 1, and foreign equipment business is expected to develop with the passage of the Edge bill. Operations of this works, in common with other equipment concerns, were largely influenced during the past year by the unprecedented fall in foreign exchange, which curtailed foreign purchases. Business was also curtailed by the cutting of expenditures by the United States Railroad Administration. In 1919 the Baldwin Locomotive Works built 1,098 locomotives.

Philadelphia's importance as a shipbuilding center was emphasized recently with the completion of the largest erecting

crane in the world at the League Island Navy Yard. It was built by the McMyler Interstate Company, of Cleveland, for the navy's bureau of docks and yards. The lifting capacity of the crane is 350 gross tons. It is to be used for fitting out vessels of all types, and especially in overhauling warships. It has the necessary capacity for lifting complete gun turrets, and for transferring them from the docks to the vessel's deck without dismantling.

The Standard Tin Foil Corporation, Cedar and Tioga streets, is erecting a two-story brick plant, 130 by 260 feet, to cost about $200,000 with equipment.

The American Tin Smelting Corporation was recently incorporated at Dover, Del., under the laws of that state, with a capital stock of $2,500,000, for the purpose of "maintaining mills for the treatment of all kinds of mineral bearing ores." The company is reported to have bought the plant of the Magnolia Metal Company, which was operated during the war by the government for the manufacture of solder, etc.

The Pennsylvania Forge Company, Jenks and Bath streets, will build a new rolling mill, 100 by 200 feet, to cost about $30,000. The company's capital stock has been increased from $400,000 to $500,000.

The Tabor Manufacturing Company, Eighteenth and Hamilton streets, manufacturer of foundry machinery, is planning to build a one-story addition of concrete and steel, to cost about $50,000.

The Ford & Kendig Company, 1428 Callowhill street, manufacturer of steam specialties, has increased its capitalization from $500,000 to $1,000,000.

The American Manganese Manufacturing Company, Bullitt building, has given notice of an increase of indebtedness from $125,000 to $250,000.

The Gomery-Schwartz Motor Car Company, 128 Broad street, has drawn up plans for an eight-story brick and concrete machine works and auto. service station, 135 by 445 feet, at Twenty-fourth and Market streets, to cost $1,000,000 with equipment.

The Victor Talking Machine Company, Camden, N. J., is enlarging its plant, and expects to have the new equipment in operation early in the year.—G. B. G.

COLUMBUS, OHIO

JANUARY 19, 1920.

The metal market in Columbus and central Ohio territory has shown considerable strength during the past few weeks and as a result prices on all metals are advancing. The advance on tin and zinc has been on the average of 2 to 2¼ cents on the pound. In fact all metals have shared in the renewed strength and the price list is now definitely tending upwards.

Demand is becoming better in all localities. Metal-using concerns are in the market for stocks, both for current needs and with a view of accumulating some reserves. On the whole, the desire is not to accumulate large reserves, but to be comfortably fixed in case of emergencies. Shipments are coming in fairly promptly, as the railroads are handling consignments more promptly than formerly. The stocks in this section are only fair, but sufficient for all purposes and there is no marked scarcity to report.

A better feeling is shown in all sections and people are now more inclined to take a chance on the future. This is apparent in the case of the larger consumers, who are contracting for shipments to come along during the coming few months. The tone is generally satisfactory and prospects for the year 1920 are said to be bright. There is no special labor trouble in this section and all metal-using concerns are working along steadily.

Tin is up from 2 to 2¼ cents on the pound. Zinc is up about a like amount. Copper is selling well and advances have also been recorded. Ingot Lake Erie copper sells at about 19 cents per pound. Brass is selling at 18 to 18¾ cents for red and 14½ to 15 cents for yellow. Type metals are strong, and there is a good steady demand. Other metals show unusual strength.

The Ohio Metal Company, which is a large jobbing concern at Fourth street and Fourth avenue, has put another man on the road, Thomas Combine, who started out the first of the year. Milton Loeb, a son of the owner, Henry Loeb, has also been on the road for some time, after coming out of the aviation department of the U. S. Army.

The Toledo Enameled Ware Company, of Toledo, has been chartered, with a capital of $300,000, to manufacture enameled ware, by Seymour Hirsch, George H. Beckwith, Alexander L. Smith, L. Van Luven and L. R. Wickenden.

The authorized capital of the Enamel Products Company, of Cleveland, has been increased from $125,000 to $225,000.

The Standard White Metals Company, of Elyria, Ohio, has been chartered, with a capital of $90,000, by George Stevens, John K. Nece, Frank M. Stevens, W. H. Stark and S. M. Squire.

The Berger Brass Company, of Cleveland, has been chartered, with a capital of $20,000, by M. W. Bruml, H. L. Taylor, C. I. Goldsmith, H. S. Goldsmith and Lewis Drucker.

The Ohio Metal Utensil Company, of Cleveland, has been chartered, with a capital of $10,000, by Jacob Hartman, E. J. Thobaben, A. L. Lang, Henry H. Rose and Soloman Hurvitz.

The Paramount Metal Spinning and Stamping Company, of Cleveland, has been incorporated, with a capital of $50,000 by Bernard Holz, S. A. Thorman, M. E. Blum, A. Krejci and Charles A. Lefkovitz.—J. W. L.

CLEVELAND, OHIO

JANUARY 19, 1920.

Preparations for what is expected to be the biggest year in manufacturing in the history of the country, and one in which the Cleveland manufacturing trades will figure largely, is already being made by the members of the metal industry branch of business in the northern Ohio district. The factor that will stimulate business, it is declared, is that of reduced production in all lines during the past year.

Every line of activity, from the automobile business, as the principal taker of metal requirements, down to small industrial interests, will be a big consumer, it is believed, based upon the number of orders for machinery, equipment and materials placed during the last few months of 1919. In one sheet metals firm it is stated that $1,000,000 business already has been closed, where in normal years $50,000 business at this time would not be bad. There has been much inquiry during the inventory taking period, presumably preparatory to placing of orders soon after the first of the year.

December was the most eventful month of an eventful year, as far as Cleveland industry was concerned. First, it was marked with the arrival of real winter weather, with the result of an easing up in the labor situation, many workers preferring to enter indoor employment, and thus making for better production. The steel strike was hardly settled, at least as far as resumption of production was concerned, when the coal strike situation assumed alarming proportions. Steel plants were expected to close down again for lack of fuel, inasmuch as the Garfield fuel restrictions, similar to those during war time, were expected to close many industries. More than 25,000 workers in Ohio industrial establishments were expected to be out of work, and production correspondingly reduced. Acceptance, in part at least, by Ohio coal miners of settlement on wages and working hours, resulted in the latter returning to work, and a gradual withdrawal of the restrictions has followed. By the middle of December the local Federal Fuel Committee was parceling out coal, so that all industries could run in part, and with the turn of the year it now seems as though the crisis were past. While Ohio mine operators look upon the coal strike settlement as but a truce, and that the struggle may be renewed later in the year, the immediate difficulties are over.

What is expected to be the third largest brass and copper smelting and refining plant in the country, is planned for Cleveland by the A. W. Kilbourne Company, a new $1,000,000 Ohio corporation. The new plant will have as its first unit buildings covering a plot 150 by 300 feet, with a capacity of 60 tons of material a day. The annual output is expected to exceed $4,000,000. The company was organized to serve the Cleveland district industry particularly. Within a radius of Cleveland, it may be known, 50 per cent of the brass and copper castings of the country are made. Officers of the new company are: President, E. I. Heinsohn, president of the United Copper Products Corporation; vice-presidents, Ralph R. Parish, metallurgical engineer; Edward A. Noll, president the National Tool Company; secretary, Lloyd H. Pool; treasurer, R. H. York. The company was organized by Paul E. Cleveland, Guardian Building, this city.

Promise of more new plants for the Cleveland district for the

new year is greater at this time than in previous years. Among those to be identified with the metal industry will be the Bailey Meter Company, American Tube and Pipe Bending Company, Pierce Plating Company, Drew Electric Company, Wheeler Radiator Company, Coburn Machine Company, King Tool Company, Marsh Motor Car Company.

New outlet for material is seen in the announcement at the Glenn L. Martin Company of plans for considering the manufacture of wireless telephones. Tests have been completed under the direction of F. S. McCullough, wireless inventor of the Martin organization. The initial manufacturing will be devoted to the production of transmitters, and eventually efforts may be made to produce a commercially practicable instrument.

The Brost Pattern Works Company was the victim of robbers who wrecked a safe and got away with $300 cash and Liberty bonds.

R. E. Carpenter, manager of the Lynite department of the Aluminum Castings Company, was a speaker before the joint meeting of the Cleveland section American Society of Mechanical Engineers and the Cleveland Engineering Society at Hotel Statler. Mr. Carpenter spoke on the meaning of industrial research.

Emil A. Bartunek, for several years county naturalization clerk, has been appointed welfare director and employment manager of the Vachek Tool Company. In his work of the last six years, Mr. Bartunek has supervised the naturalization of thousands of foreigners, and also has been instructor in Americanization classes here.

W. J. Beck, director of research of the American Rolling Mills Company, Middletown, Ohio, addressed the Cleveland Engineering Society on the manufacture and magnetic testing of electric sheet.

William C. Holmes, founder of the William G. Holmes Bronze Company, located at Bedford, died December 1, at Silver City, N. M., and was buried here December 6. Mr. Holmes had been a business man of Cleveland for nearly ten years.

William R. Roberts, president of the Brooklyn Savings and Loan Association, died December 29, at the age of 78. He was best known to business interests here as the founder of a sheet lead business some forty years ago, which later became the present Gibson & Price Company, and of which he remained vice-president. For the last fifteen years he had been identified principally with the banking business here.—C. C. C.

TRENTON

JANUARY 19, 1920.

The Trenton metal manufacturers have enjoyed a very properous season during the year 1919 despite the many conditions that confronted them. As one manufacturer said that keeping the plant busy did not mean that things were prosperous. It was the profits to be made and the settled labor conditions that counted. Frequent demands for increased wages and shorter hours and the uneasiness of the building market are the troublesome things for the manufacturer. The manufacturers believe that the coming year will be another prosperous one from all standpoints. It is going to be a record year for building and it is believed that the wage situation has been settled. It is not thought that there will be any serious labor trouble because the wages now paid are very high, and it is not likely that the manufacturers will agree to any further advance in pay to those who are already receiving good salaries. Many important building operations held up during the war will be begun early in the Spring and this alone gives promise of a very prosperous year. Big jobbers in various parts of the country are out of stock and must be supplied during the next few weeks.

While the recent coal strike has had no effect upon the local manufacturers, yet some concerns are getting anxious about their supply of bituminous coal and have not very much on hand. It is believed that there will be a shortage before the Winter is over. The Trenton branch of stationary engineers is advocating the more general use of fuel oil. Several lectures have recently been given before the local organization in which it was shown that the oil fuel was not only more economical but would also prevent a shutdown in case of a shortage of coal. It is believed that the plants will take more to oil fuel in the time to come.

The strike of the several hundred employees of the Keystone Watch Case Company and the Riverside Metal Works, which was inaugurated some time ago, has been brought to an end. The union gave up the fight. The strike, it said, was agitated by New York labor union officials. Many of the older employees lost their positions and had to find work elsewhere. The strike was marked with considerable disorder and many arrests were made. The Watch Case Company has one of the largest plants of its kind in the country. It is said that the labor union will now disband and in the future men will have to settle their grievances individually with the concern.

The Advance Metal Stamping Corporation, of Newark, N. J., has acquired the adjoining property on Leslie Street and will erect new buildings in the future. The plant of the American Metal Bed Company, 42 Clifton Street, Newark, N. J., was recently badly damaged by fire. The blaze was caused by overheated pot stoves used while the heating apparatus was being repaired.

Simon-Gartler Corporation, of 31 Clinton Street, Newark, N. J., has been incorporated with 125,000 capital to manufacture metal windows and skylights. The incorporators are Meyer Simon, Samuel Gartler, Harry Wasserman and Harry Bennett, all of Newark.

William O. Bartlett, an architect, is drawing plans for an undisclosed concern for the erection of a big metal bed factory on Elizabeth Avenue, Newark, N. J. The factory will be completed within the next three months. The structure will be 140x240 feet and there will be a power house of 32x52 feet. These buildings will be the first units of a plant to be considerably enlarged later. The plant will cost $130,000.

The Irving Plating and Tool Company, of Irvington, N. J., has been incorporated at Trenton with $50,000 capital to manufacture tools, etc. The incorporators are J. L. McKenna, of Newark; Edward Roesken, of Belleville, and J. R. Rafferty, of East Orange.

The Motor Starter and Air Pump Company, of East Orange, N. J., has been incorporated at Trenton with $200,000 capital to manufacture air starters for motors, etc. Gordon Grand, E. O. Picking and M. V. McKenzie, all of East Orange, are the incorporators.

August Heckscher, of the New Jersey Zinc Company, has given $200,000 to the endowment fund of Rutgers College, New Brunswick, N. J. Colonel Washington A. Roebling, head of the John A. Roebling's Sons Company, Trenton, N. J., has contributed $25,000 as an addition to his previous contributions to the dormitory fund of the Rensselaer Polytechnic Institute, Troy, N. Y. Colonel Roebling is a veteran engineer and completed the erection of the Brooklyn bridge at the death of his father, John A. Roebling. The former was graduated from the Troy institute in 1857.

C. A. L.

LOUISVILLE

JANUARY 19, 1920.

The manufacturing jewelers had an unusually good year, and were busy from start to finish, there being a lot of work held over into the new year. Engravers and other handlers of fine metal work also had an excellent season as a whole.

A decided increase in general industry in Louisville along with an increase of production in automobiles, farm implements, wagons, milk machinery and many other lines, has resulted in larger demand for copper, brass, aluminum and other castings and raw material.

Railroad operations during the year took quite a great deal of brass journals, and other brass goods, but, new car building was below normal probably, as many shops were not busy. However, with the return of railroads to private control indications are that the big shops of the Louisville & Nashville R. R., and the American Car & Foundry Shops, at Jeffersonville; Continental Car Co., and others will have about all that they can do.

Building operations took a great deal of builders' hard-

ware, plumbing, etc. Building operations this year were the largest since 1914, the total being 2,261 contracts, costing $4,038,664, whereas in 1914 there was only a small increase. Prospects for 1920 are very bright, as there are several millions of dollars of work in sight, including some large garages, additions to textile mills, enlargements of implement and wagon plants, installation of two or more dairies, and important oil operations. Several new refineries are being erected in the state, and the Kentucky Standard Oil Co. has just announced an addition to cost $2,000,000.

At the present time Louisville coppersmiths are busy on general work. No one is especially rushed, but everyone reports a good volume of business on hand and in sight, coming from many quarters. In the old days Louisville concerns were kept fairly busy with home industry, and building a few breweries and distilleries at a distance from the city. Today they are taking more local work in other lines, and securing more business from out of the city, as they are going after it.

Concerns with facilities for finishing up castings as well as making the original are in position to secure a good deal of automobile as well as talking machine business, as those industries are working overtime, and there is also a big demand for piano parts.

Indications are for a very big year in plumbing supplies of all kinds. The Ahrens & Ott plant of the Standard Sanitary Mfg. Co., Louisville, has recently taken out a permit for a $50,000 addition to the plant which was enlarged last year. The company is now employing about 2,500 people, and paid handsome bonuses to all employees on the year's work.

P. A. Vogel & Sons, for many years jobbing plumbing, mill and factory supplies on Main Street, as a firm, has filed articles of incorporation as P. A. Vogel & Sons Co., with Adolph Vogel as president and general manager. The company has sold its old store to the Belknap Hardware & Mfg. Co., and will shortly occupy larger and better quarters near Third and Main.

The Kentucky Wagon Mfg. Co. has taken out permits for additional building in order to increase production of pleasure cars and trucks.

The Independent Brass Foundry has had a rattling good year, and has grown so fast that even with two shifts it is impossible to get out the work. Plans have been made for moving into larger quarters shortly.

The Standard Milk Machinery Co. reports the best year in its history, which is also true of Hines & Ritchey, a subsidiary copper working concern. The past year was a big one in improvement of milk plants, and much machinery was purchased.

General indications are for a busy season in 1920, due to the fact that general industry is humming, and many small industries are having much of their casting work done on the outside. The big increase in automobile business is also resulting in many small concerns putting out appliances, for which they have castings made locally. The casting end of the copper trade is promising, but tube and sheet work is not as promising as in other years. A good deal of work is in sight in connection with brass railings, grills, etc., for banks, offices, etc., but on general sheet metal work the soft drink people and soap companies are the only promising customers just now. A. W. W.

CHICAGO

JANUARY 19, 1920.

With a remarkable, not to say exciting, year closed, and with one of still greater possibilities well under way, the metal trades in Chicago are in a position to take care of whatever may come their way in a spirit which has been developed with the war to a point where it means greater accomplishments and greater cooperation than ever before.

The trade did well, as a whole, during 1919, having capacity business in all departments, and being hampered relatively little by labor trouble of the sort which in some industries has served to curtail production seriously. In many instances wages were voluntarily advanced by employers to meet the acknowledged increases in living costs, and thus workers were given first-hand and indisputable evidence of the desire of their employers to be fair with them.

Thus, in spite of one or two strikes in concerns connected with the trade, labor conditions have as a rule been better than those in many other industries. The average earnings of men employed in the industry are high, and production is running at a point which means prosperity for all concerned.

Most encouraging of all, in this connection, is the definite evidence which is available of the understanding on the part of the men of the necessity for steady and increasing production. It has become generally known among financiers and economists that production is the great need of the country, and the fact that in Chicago, at least, many of the workers share this knowledge is extremely significant.

A striking and authentic instance of this sort, vouched for by Wm. M. Webster, commissioner of the Brass Manufacturers' Association, occurred at a big Chicago plant connected with the brass trade. The plant had been placed on an eight-hour-day basis some time ago, by the voluntary action of the company operating it; but in view of the increasing demand for its products, the proposition was placed before the men of returning to a nine-hour basis. A vote was taken, the result of which was an indication that 97.7 per cent of the entire working force desired to return to the nine-hour day—with an extra hour's pay for the extra hour's work, of course; and the following day the remaining 2.3 per cent of the force, having talked the thing over, fell in line, making the matter unanimous. The plant promptly went on a nine-hour basis, thus increasing its production by 12.5 per cent, at least.

The fact that the average plant, taking the trade as a whole, is sold up four or five months ahead indicates with sufficient emphasis the necessity for precisely this sort of action; and no more encouraging indication of industrial sanity among the rank and file could be given than such a vote as that referred to above.

A piece of splendid constructive work, which is certain to have far-reaching results, is that which has just been completed by the Brass Manufacturers' Association. This is the new catalog of standard goods, perfected largely as a result of the experience acquired during the war in the elimination of superfluous and non-standard sizes, patterns and parts. The new catalog will determine the goods to be made by the manufacturers, carried in stock by jobbers and used by consumers; and the widespread appreciation of its importance, from this standpoint, is indicated by the fact that Mr. Webster's office has already received requests from 45,000 concerns for copies.

"Last year was one which was highly satisfactory, everything considered," remarked this Association official, "and prospect for 1920 are of the brightest, as far as our industry is concerned. If business as a whole rounds to as rapidly as ours has done, the coming year should be one of the most active and prosperous in the country's history."

MONTREAL, CANADA

JANUARY, 19, 1920

Canada has well demonstrated that during both war and peace periods she can take care of her home needs and also the world export trade, and with great advantage to herself, as the past record of business will show in the metal manufacturing lines.

It is true that Canada has a heavy debt, but it is also true that the country is better off than it ever was before. If ever people had for their own making a great and permanent prosperity, the Canadian people have it. Today all the country needs is work and production as intense as possible and the exclusion of waste and extravagance everywhere, for a better and stronger Canada.

There is only one thing that is giving the manufacturing interests in the metropolis of Canada grave concern, and that is the money rate of exchange. This past month one of the leading Montreal metal manufacturing concerns cancelled a large order with one of the leading tool machine manufacturers of Cleveland, Ohio, for new equipment, on an addition it has in the course of erection to its plant, as the rate of exchange in money values brought the figures too high. Negotiations are in progress for the machines to be manufactured here in Montreal.

A continuance of the united and co-operative efforts so general throughout the war, coupled with a fair and generous recognition of the rights and duties of employers and employes will insure the manufacturing interests of the Dominion a successful year. Concerning the prospects for the metal manufacturing industries of Montreal and surrounding districts for the coming year, shows that the future looks auspicious from the amount of business they have on hand, and inquiries on file.

Fall trade in all metal lines has been above normal. With the large additions now in course of construction, and some of them completed, it will enable the different factories to considerably increase their production next year. The Birks Manufacturing Company has purchased ground at the southeast corner of St. Monique and Cathcart streets and the architects are working on plans for a ten-story factory building. It is intended that this ten-story Birks Craft Building shall be a fitting home for the choice production of this firm. An important addition to the factory of the McLary Manufacturing Company, Wellington street, has been announced by J. C. Newman, manager of the company, who has purchased the lot corner of Wellington and Greynun streets, adjoining the present premises of the company. The purchase price of the property, which includes about 12,000 square feet, is $42,000, or approximately $3.50 a foot.

Plans are being prepared for the erection on this site of a modern four-story building. Operations will commence the first of January.

The low stocks on hand by the manufacturers or the jobbers held in stock on brass builders hardware and plumbing also steam brass goods and the active demand for same is becoming more pronounced every day, thus keeping the prices on above goods at a high water mark.

The high discount rate on the Canadian dollar this past two weeks has been the cause of cancellation of orders for tools and new machinery for the new plants in course of construction here, and all parts of Canada, and probably will develop the manufacture of tools and machines in Canada. Canadian purchases in the United States covering a long period have been greatly in excess of her sales. During September the United States sold to Canada $77,980,468 worth of goods while Canada sold to the United States $45,658,583. It will be shown this month where the high discount is going to have a serious effect to the manufacturers of the States as the demand for their goods will be at a low ebb.

The Jenkins Bros. Co., Ltd., have made their annual distribution to their employes of a bonus or Christmas gift covering the service of the number of years in the employ of the company. This is participated in by every employe from the office boy and apprentice to the managing directors, and shows that the company is desirous of sharing its profits with the employes.

One of the features of the Montreal trade has been the heavy demand for foundry supplies this month. This has been the cause of the Woodison Foundry Supply Company of Toronto and Windsor, Ont., opening a branch warehouse to take care of their rapidly developing business in the eastern part of Canada and Maritime Provinces. Mr. J. Jerosky, an old experienced foundryman, is at the head of the new branch and reports his sales for this month far in excess of any month this year.

The price on babbitt and type metals is holding up remarkably well. Copper is also in fair demand with the price ranging from 19½ cents to 21 cents per pound.—P. W. B.

BIRMINGHAM, ENGLAND

JANUARY 12, 1920.

Business in all the branches of the non-ferrous metal trades has shown a continuous improvement up to the end of the year. Manufacturers for a long time were tempted by the overwhelming demands and high prices of the home market to neglect export trade, especially in view of the shortage of labor and the difficulties of the shipping situation. In view of uncertainties as to labor conditions and the cost of materials the rule has been to accept orders only subject to prices ruling at the time of delivery. This proved for a long time a great deterrent to foreign buyers. During the last month or two there has been a decided improvement in export trade. Buyers abroad, driven by necessity, have ceased to hold off in the hope of reduced prices. Further demobilizations have improved the labor supply and, though wages have been recently further advanced and the working week reduced to 48 hours, the situation as regards labor costs is nearer being stabilized than at any previous time since the armistice.

Water, steam and electrical fittings are the subject of a large and increasing export demand. The new housing schemes which are being fostered by the Government are providing a great deal of work for the metal trades and there have just been allotted, chiefly in Birmingham, contracts for water fittings for upwards of 20,000 houses. The specifications have been framed in consultation with Government experts and one result has been an increased movement towards mass production and co-operative work among firms in the brass trade.

The aluminum hollow-ware industry has made very rapid progress in the Birmingham district since the war. Old factories have been extended and new ones have been established. A Birmingham firm is building a factory at Stratford-on-Avon.

The national strike of iron molders and core-makers, which has lasted now over three months, has done serious injury to the engineering trades and all industries in which iron and steel castings are used. Many engineering departments have come to a standstill. Efforts have been made to meet the difficulty by importing castings from America and Belgium, but the men in the engineering shops refuse to work upon any material which they regard as being obtained in order to "blackleg" the strikers.

Directly, the strike has not affected the brass trade to any appreciable extent. The unions to which the brasscasters belong have taken no part in the strike, and so far there is no indication of any sympathetic action. At the same time there is a determination to refrain from touching any work that may be regarded as "black." For instance, attempts made to replace certain small iron castings with brass resulted in the closing of one factory which works for the motor-car trade. The only non-ferrous industry to which the strike has really spread is aluminium castings, most of the aluminium foundrymen being in one or other of the unions which declared their strike. In Birmingham some 200 or 300 or these men remain idle out of loyalty to their union, though they themselves have no grievance and would prefer to be at work.

Negotiations, after having been broken off time after time, have been resumed, and it is hoped that a settlement will be reached before the end of the year. There is a danger, though, in the opinion of some, not a very great one, of the strike itself spreading through the non-ferrous trades. It is announced that in the event of the present negotiations not resulting in a settlement the Federation of Foundry Unions, representing 80,000 foundry workers, will be asked to ballot their members on the question of a down tools policy. As the brassfounders' unions are allied with the Federation they would have to consider this appeal. Generally speaking, they are not very much in sympathy with the strikers. Although they believe that the iron foundrymen had grievances they consider that the wrong course was taken in withdrawing from the agreement by which engineers and foundrymen's wages were to be considered periodically by the Government tribunal. This tribunal has recently awarded an advance of 5 shillings per week to meet the increased cost of living, and this, it is thought, will assist the disputants in arriving at a settlement. It has not been as yet applied to brassworkers generally as previous awards have been, as the Brassfounders' Employes Federation, a body which has taken the place of the old Brassmasters' Association, considers that in a rearrangement of wages recently made the advance was anticipated. This matter has been referred to arbitration by the new Industrial Tribunal in London, by which all such questions are now adjudicated.

The application of science to industry in the non-ferrous metal trades has made considerable progress during the past year. As the result of a meeting in Birmingham of representatives of the brass and kindred trades from all over the country it was decided to establish a British Non-Ferrous Metals Research Association. The headquarters of the association will be in Birmingham. Owing to the difficulty of obtaining suitable premises nothing practical has yet been done, but the preliminary work of organization is now completed. The association, which will be aided by Government grants, includes in its program the promotion and co-ordination of research and the collection and indexing of all publications throughout the world bearing upon the non-ferrous metals. It is not intended that the association

should have its own laboratory, but, in consultation with manufacturers, it will arrange for investigation in universities, the existing public and private laboratories and in works, of problems of practical interest to its members. In the meantime some practical steps have been taken locally. The scheme of a co-operative laboratory for the brass trade has been merged in the National Association, but two important laboratories have been started during the year, that of the Midland Laboratory Guild, formed by a number of metal rolling and tube firms in the Birmingham district and the Brass & Copper Research Laboratory, which works in Birmingham under the direction of Professor T. Turner, of the University. The Birmingham Corporation Gas Department, which is pushing the use of gas for industrial heating, also has a Research Laboratory in which some valuable work on the heat treatment of metals is being done.

This progress is largely due to the stimulus given by metallurgical exigencies of the war. Another result has been a great increase in the activities of local technical societies. The Birmingham Metallurgical Society, which formerly numbered its membership by tens, and during the war became altogether inactive, has been revived during the past year or two and now has a membership of over 700. It is chiefly occupied with problems connected with the non-ferrous metals, but does not exclude iron and steel. Upon both classes of subjects it has had some excellent papers by leading investigators. The membership is believed to be a record figure for a local technical society. The British Foundrymen's Association has lately been legally incorporated under the title of The Institution of British Foundrymen. A new branch has been formed at Coventry, while the Birmingham Branch is still flourishing.—H. & G.

VERIFIED NEWS OF THE METAL INDUSTRY GATHERED FROM SCATTERED SOURCES

Paul Wenger Company, 56 Liberty Street, New York City, has changed its firm name to **Paul Wenger Corporation.**

The American Hardware Corporation has let contract for a new brass foundry building for their P. & F. Corbin Division 62 x 164 feet, two stories high.

The Hope Fan & Blower Company, Seventy-third and Lydia streets, St. Louis, will equip an additional building for the manufacture of ventilating machinery.

Fry's Metal Foundry, 25 Holland Street, London, England, chased the interests of the Solid Steel Scissors Company, Fremont, Ohio. They have a large plating room.

The Flexible File Company, Fremont, Ohio, have purwould like to hear from firms in this country with regard to importing, exporting, selling or manufacturing metals.

The Tilly Brass Mfg. Company, 3420 South Main street, Los Angeles, Cal., has filed notice of organization to manufacture brass products. Norman Tilly, 2670 North Sichel street, heads the company.

A petition in the matter of the **Metals Production Equipment Company,** bankrupt, returnable the 21st of November last, for authority to assign rights to damages for infringements was allowed by the referee.

For the purpose of increasing its output of marine motors, the **Gilmore Marine Motors Corporation,** Detroit, Mich., recently filed articles of incorporation. The firm has added a brass and iron foundry to its plant.

On January 1, 1920, all of the sales and contracting business that has for many years been carried by the **General Fire Extinguisher Company** was taken over by a new company, **Grinnell Company, Inc.,** Providence, R. I.

W. A. Fuller Company, Inc., Greensburg, Pa., have opened up a distributing station for New York and New Jersey. This new distributing branch will be in charge of George H. Christensen, 60 Midland avenue, Glen Ridge, N. J.

The St. Louis sales office of the **Standard Underground Cable Company,** Mr. E. J. Pietzcker, Manager, will on February 1, be removed from the Security Building, where it has been located since 1897, to the Arcade Building.

The Gehnrich Indirect Heat Oven Company, 60 Franklin avenue, has awarded a contract to Louis Gold, 44 Court Street, for a two-story plant, 125 x 200 feet, at Buckley and Skillman streets, Long Island City, to cost $100,000.

The Electric Furnace Construction Company, Finance Building, Philadelphia, advises that an order has been received for a "Greaves-Etchells" electric furnace from Lacheze et Fils, Dijon, France, to be used for non-ferrous metals.

The Standard Metals Refining Corporation, South Bend, Ind., has been incorporated with $50,000 capital stock to manufacture and refine metals. The directors are Maurice L. Hurwich, Benjamin L. Frank, and Clarence C. Walters.

Hanson & Van Winkle Company, manufacturers of platers, polishers and electro-galvanizers' supplies have moved their New York store from 81 Walker Street, where it had been located for many years to 70 Lafayette Street, corner Franklin.

The Springfield Aluminum Plate and Castings Company, Springfield, Ohio, has been organized to manufacture aluminum castings, etc., by William Jordan and others. They operate an aluminum foundry and soldering and polishing departments.

Forsyth Metal Goods Company, East Aurora, N. Y., has increased its capital from $30,000 to $75,000. This company has a tool room, grinding room, brazing, soldering, tinning, stamping, plating, polishing, japanning and lacquering departments.

The Bozeman Mfg. Company, Inc., 312 West Redwood street, Baltimore, has been organized to manufacture plumbing specialties. J. Walter Bozeman, formerly associated with the Wolverine Brass Works, Grand Rapids, Mich., is president.

The Edro Richardson Brass Company, 318 North Holiday street, Baltimore, has received bids for the establishment of a brass foundry and shops. This firm operates a brass, bronze and aluminum foundry, brass machine shop, and tinning department.

Frank L. Bridges and **Peter Lambertus** were named among the incorporators of the **Acme Aluminum & Brass Works,** Indianapolis, which was recently chartered with $40,000 capital. They operate a brass, bronze and aluminum foundry and grinding room.

The Driver-Harris Company, Middlesex avenue, Harrison, N. J., manufacturer of wire products, has awarded a contract to E. M. Waldron, Inc., 665 Broad street, Newark, N. J., for a three-story works building to cost $50,000. They operate a casting shop and rolling mill.

Johnson Matthey & Company, Ltd., Hatton Garden, London, England, refiners and dealers in platinum and precious metals, have leased through Horace S. Ely & Co., 8 and 10 Liberty place, New York City, for twenty-one years. They operate rolling mills and tool room.

The Allis Manufacturing Company, Milwaukee, Wis., was recently incorporated, with a capital of $50,000, by Paul M. Kuder, Otto J. Juttner and John Garvey. They will manufacture brass and bronze castings, and operate a brass, bronze and aluminum foundry and grinding room.

A contract has been let by the **Ashland Brass Foundry,** Ashland, Ohio, for the erection of an office and foundry building, 45 x 70 feet. They will make all kinds of brass and aluminum castings, specializing with aluminum match plates, operating a brass, bronze and aluminum foundry.

The Aluminum Specialty Company, 17th and Wollmer streets, Manitowoc, Wis., has awarded the contract for a

two-story, 60 x 200 ft. factory, to be erected on Main street, Chilton, Wis. Estimated cost, $75,000. They operate a tool room, spinning, stamping, and polishing departments.

Paul L. Turgeon, accountant, of Montreal, has been appointed liquidator to the **Canada Stove & Foundry, Ltd.,** in liquidation, by judgment of the Superior Court, District of Montreal, dated December 15, 1919.

The Somers Company, Baldwin avenue, Waterbury, Conn., manufacturer of bronze and sheet brass products, has commenced the erection of a one-story addition 50 x 144 feet, to cost about $15,000. The new building will be used for an annealing department. The construction will be of steel and concrete.

The O. J. Moussette Company, Inc., manufacturers of Monarch cinder mills, smelters' sweep mixings and other machinery, announces the removal of their executive offices to suite 2110, 220 Broadway, New York. They are now more conveniently located and state that they can give much better service than heretofore.

Federal Brass Works, Detroit, Mich., having specialized exclusively in the manufacture of babbit-lined bronze-back bearings and bronze bushings for the past three years, and intending to continue manufacturing these parts exclusively, will be known in the future as the **Federal Bearing & Bushing Corporation.**

Construction of a foundry 100 x 150 feet, is being planned by the **Great Falls Iron Works,** Great Falls, Mont. Electrically operated cranes will be installed. They operate a regular gray iron foundry; gray iron, brass, bronze, regular jobbing machine shop, structural shop, blacksmith shop, boiler shop, pattern shop.

The American Zinc Products Company, Greencastle, Indiana, has installed a complete line of roofing machinery for the manufacture of "Old Chateau Zinc Roofing" and are now prepared to fill the orders promptly for all sizes and forms of corrugated and V-crimped sheets. Also flat sheets in all thicknesses and sizes as well as zinc ridge roll.

The American Bosch Magneto Company, Springfield, Mass., manufacturers of magnetos, etc., is having plans prepared for a 10-story works building 80 x 100 feet, at 17 West Sixtieth street, New York, to cost about $200,000. Bond & Company, 476 Main street, Springfield, are the architects. Local offices of the company are at 223 West 46th street.

The Keeler Brass Works, Godfrey avenue, Grand Rapids, Mich., has commenced a plant addition 75 x 100 feet, to cost $25,000. Also addition doubling foundry capacity and still another 30 x 200 feet of additional machine room capacity. They operate a brass foundry, brass machine shop tool room, stamping, polishing, japanning and lacquering departments.

The proposed addition to the plant of the **Plume and Atwood Manufacturing Company,** Thomaston, Conn., calls for a building 60 x 30 feet. It will be used for a saw room and plater's department. They operate a brass machine shop, tool room, casting shop, rolling mill, cutting up shop, spinning, stamping, tinning, plating, polishing and lacquering departments.

Announcement was made January 1 of the incorporation of **The National Steel Products Company,** Dayton, Ohio, for the purpose of taking over the combined plants and assets of **The National Vacuum Machinery Company** and **The Crown Hardware Manufacturing Company,** with greatly enlarged capital and additional facilities for the expansion of their rapidly growing business.

The Simmons Company, 198 Bay street, San Francisco, manufacturer of brass and iron beds, has awarded the contract for a 135 x 278 ft. factory to be erected on Stockton and Bay street. Estimated cost $100,000. They operate a brass, bronze and aluminum foundry, tool room, grinding room, casting shop, rolling mill, brazing, plating, japanning and lacquering departments.

Fundición y Talleres "La Union" 4056-82 Calle Corrientes Buenos Aires, Argentine Republic, S. A., are about to make a new iron foundry, 120 ft. by 200 ft., and also to increase their brass foundry, and will be pleased to receive catalogues for all classes of foundry equipment and molding machines for light work. Prices to be given where possible, in order to avoid delay in correspondence.

The Taylor Forbes Company, Ltd., Guelph, Ont., will build an addition to its foundry to cost $35,000. P. H. Secord & Sons, 133 Nelson street, Brantford, Ont., have the general contract. These people operate a brass, bronze and aluminum foundry, brass machine shop, tool room, grinding room, casting shop, stamping, galvanizing, tinning, plating, polishing, japanning and lacquering departments.

The U. S. Electro Galvanizing Company and **The National Galvanizing and Plating Equipment Corporation,** of 52 Broadway, New York City, have arranged to consolidate under the name and present organization of the U. S. Electro Galvanizing Company, for the purpose of manufacturing and selling the full line of Patented Automatic Apparatus for Cleaning, Plating and Electro Galvanizing, formerly manufactured by each company.

The United Smelting & Aluminum Company, Inc., of New Haven, Conn., announces the election of Mr. Frederick A. Merliss as Vice-President and his appointment as Manager of Sales. Mr. Merliss has been connected with the company for the past three years as assistant secretary, and his new appointment fills the place left vacant through the resignation of Mr. L. M. Brile, former vice-president and sales manager.

The Artcraft Metal Stamping Corporation, 1032 Myrtle avenue, Brooklyn, N. Y., has been recently organized by D. Shapiro, S. Shapiro and J. Shapiro, formerly members and officers of the Reliance Metal Spinning & Stamping Company, of Brooklyn. Their plant takes in the entire building at the above address, where they have every facility for the manufacture of high grade stampings and spun metal products.

The Wolverine Tube Company, formerly located at 33d and McGraw avenues, Detroit, Mich., have moved to their new home at 611 Central avenue, where they have greater facilities for producing their line of small sizes of Seamless Brass and Copper Tubing. Their present plant consists of 2½ acres of land and 30,000 ft. of floor space. This company was purchased last April by a group of men, who have long been connected with this industry.

Incorporation papers have been filed by the **Thomann Bronze & Brass Foundry, Inc.,** Medford, Mass. The company, which is capitalized at $10,000, was incorporated by Charles E. Thomann, William Klingenberger and Albert H. Thomann. Charles E. Thomann was for 24 years in charge of the foundry department of the Crosby Steam Gage Co., Boston, up to July 9, 1919. They operate a brass, bronze, and aluminum foundry.

The National Metal Products Company, Indianapolis, Ind., has been organized with $100,000 capital stock, to manufacture vises and steel clamps. E. E. Gates is president, John G. Wood vice-preseident, and George H. Buckley secretary-treasurer. The organization is an outgrowth of the Indiana Die Casting Company, Cornell avenue and Eleventh street. They operate a tool room, grinding room, stamping, polishing and japanning departments.

The H. M. Lane Company announces that **John A. Rathbone** has joined their staff to assist in general foundry layout work and to specialize on foundry equipment arrangement, and particularly on special molding machine and rigging problems. Mr. Rathbone has long been known to the foundry trade as a practical foundryman, in charge of various plants, and as the inventor of the Rathbone multiple molding process, which has proved very successful in certain cases. Mr. Rathbone was recently connected with the Wasson Piston Ring Company, of Plainfield, N. J.

The industrial nurses of the **National Organization for Public Health Nursing** plan to form an Industrial Nursing Section in the national organization at the meeting in Atlanta next April. The object of this section will be the formulation and maintenance of high standards for nursing service in

industry. It is planned to make known to nurses throughout the country the opportunities for education for industrial nurses. Opportunities exist or may be developed in many large centers. The program will be of interest both to industrial nurses and to employers.

The Interstate Aluminum Company, Canton, Ohio, has been incorporated with a capital stock of $25,000 and will establish a plant 60 x 100 feet, on Sixth street, in which it will manufacture aluminum kitchen utensils and specialize in percolators. T. M. Dubs is president; P. M. Barnard, vice-president; J. W. Fenstermaker, secretary and sales manager; W. M. Doolittle, manager. They will operate a tool room, spinning, stamping and polishing departments, and will require such supplies as wood handles, glass tops, hinges, paper cartons and metal rivets, etc.

A contract recently signed between the **Fairbanks Company** and the **Lincoln Electric Company,** of Cleveland, Ohio, gives this company the exclusive distribution of Lincoln Electric Motors for industrial applications. This line includes alternating current motors for two-phase and three-phase circuits in capacities from one-half to 500 horse-power, for all commercial voltages and frequencies, and direct-current motors from one-half to 150 horse-power. The Fairbanks Company will also cooperate with the various Lincoln district offices in connection with the sale of the manufacturer's other products.

The Ohio Body & Blower Company will take over three plants from The Ohio Blower Company. Plant No. 1 is the three-story plant on Perkins avenue, Cleveland, which served for five years as the exclusive home of the company. Plant No. 2 is the new plant housing the home offices, on Detroit avenue, on the West side of the same city. Plant No. 3 is the modern foundry at Orrville, Ohio, which operates exclusively on Ohio Blower Company work. These three plants provide employment for more than 600 workers in 150,000 square feet of floor space. Spring will see these figures increased to 1,000 workers and 350,000 square feet of floor space by the completion of another unit of Plant No. 2, to be devoted to the building of closed bodies.

The Massachusetts Institute of Technology's new plan of selling her consulting technical services to industry in definite contract form is attracting considerable attention in the business world. The "Technology Plan," as it is called, was evolved in connection with Tech's $8,000,000 endowment fund campaign, and to date has netted $767,700 in contracts sold to industrial concerns. Among the forty odd corporations which have signed the Tech contract are the following well-known concerns: The American International Corporation, E. B. Badger & Sons, Utah Copper Company, Goodyear Tire & Rubber Company, Pierce-Arrow Motor Car Company, Lackawanna Steel Company, Stone & Webster Affiliated Companies, and Stone & Webster, U. S. Rubber Company, and U. S. Smelting & Refining Company.

The Production Engineering Company, 212 Centre street, New York, has been organized to act as engineers to manufacturers. The officers of the company are: John A. Honegger, president; Robert Steinman, treasurer; H. Allen Hinchcliff, secretary. The firm will specialize in the designing and building of tools and machinery for automatic production with the emphasis on labor saving devices. It is desirous of securing catalogues of machine tools and specialty manufacturers for use in their reference files. In addition they wish to get in touch with all manufacturers of standard labor saving devices, in order that they may inform their clients where such standard equipment may be obtained.

A new die casting company, **The Accurate Brass Casting Company,** has been organized with a capital stock of $50,000 to manufacture brass and bronze die castings by a new and improved process. A plant is now under construction at Cooper and Wyckoff avenues, Brooklyn, N. Y., on the Long Island Railroad and was ready for operations about January 15. August G. Gutmueller, formerly superintendent for the Doehler Die Casting Company and in their employ for eleven years, is president and general manager, Martin G. Knorr is vice-president, Christopher G. Knorr is treasurer and Edwin C. Morsch secretary. The company is only putting up a small initial plant, but has several acres of adjoining land to expand on. A further statement will be made later in the year.

Doehler Die Castings Company, with its main office and eastern plant at Brooklyn, N. Y., and a branch plant at Toledo, Ohio, manufacturers of die-castings in white aluminum and brass alloys, and bronze back and aluminum back babbitt-lined bearings, has just closed the purchase of a seven-acre tract in Chicago, Ill., on which the company will erect a modern one-story concrete, steel and brick structure for the manufacture of die castings and bearings. Contract for the building has already been let and operations started. The building is to be completed and ready for occupation and operation on or about January 1, 1920.

At the annual meeting of the Board of Directors of the **Doehler Die-Casting Company,** held at its main office, Brooklyn, on January 5, the following officers were re-elected.

H. H. Doehler, president; H. B. Griffin, vice-president; O. A. Schroeder, treasurer; O. A. Lewis, assistant secretary.

They also added to their list of officers the following:

J. Kralund, second vice-president, in charge of production, and Charles Pack, secretary and chief chemist.

The Bridgeport Brass Company, of Bridgeport, Conn., has just inaugurated a plan of training for their foremen and other members of the supervisory force which is of considerable interest. A class of 73 men has been formed to pursue a course in modern production methods which comprises the study of specially prepared text material, the solution of practical factory problems, and the discussion of this material at six biweekly meetings held in the plant after hours. These meetings will provide an opportunity to bring home the application of the work to the special production problems of the company. At each meeting a lecture will be delivered by an experienced production man and the lecture will be followed by a round-table discussion. The subjects covered are:

1. How to promote teamwork in the shop.
2. Handling workers by methods that make for harmony.
3. Improved methods of factory organization.
4. Handling materials and equipment productively.
5. Reducing costs and stopping leaks.
6. Modern ideas of management.

The course is conducted under the direction of the Business Training Corporation of New York, who supply the text material and the instruction service. The lectures are also given by the staff of the Business Training Corporation. The course is not technical but deals in basic facts and principles.

HILO CORPORATION BONUS

In January, 1919, after an adjustment of wages which permitted each employe a good living wage in line with existing conditions, the Hilo Varnish Corporation announced that here thereafter the capital invested in the business would be allowed 6 per cent as its living wage and any profits accruing over that amount would be apportioned 50-50, half to the stockholders and half to the employes; every employe to participate whether from office, factory, or selling staff. This year each employe received 21.46 per cent of the salary drawn during the past year.

The Hilo Varnish Corporation is just completing a considerable addition to its factory and office and will be better able to look after the comfort of its employes and take care of its ever-growing business.

NEW PATTERN COMPANY

A. B. Machone, secretary of the Detroit Foundrymen's Association, who needs no introduction to the many readers of THE METAL INDUSTRY in the Middle West, has incorporated a company in Detroit with a capitalization of $100,000, known as the Machone Pattern and Manufacturing Company to manufacture wood and metal patterns, foundry equipments and conduct a general machine and foundry busines.

In Mr. Machone's thirty years connected with the pattern shop and foundry, he has gathered experience which makes him well fitted to produce aluminum pattern castings requiring the highest grade of foundry skill.

Mr. Machone was formerly connected with the Brown and Sharp Manufacturing Company, Providence, R. I., from 1901 to 1908. During this time he made cylinder patterns and castings of all descriptions for Packard, Pope, Hartford and several other motor concerns.

In 1908 he came to Detroit to take charge of the Packard Motor Company pattern shop. Under his directions the shop increased its force from eight to sixty-five men, and there he developed many new methods in the aluminum brass and iron foundry practice.

He went to the Aluminum Castings Company in 1913 and built their shop up from four to the present seventy-eight men. He specialized in auto crank cases and transmission patterns, and made as many as fifteen duplicate patterns and core boxes that were absolutely interchangeable.

During the war period Mr. Machone engineered the making of 80 per cent of all the patterns used for producing aluminum castings used on the Liberty Motor. Mr. Machone has been called to many air craft building stations over the country to confer with engineers regarding the design from a practical foundry standpoint. Also many of the large motor companies have called on him for advice in the same capacity.

Mr. Machone terminated his connections with the Aluminum Castings Company, Detroit, December 31, 1919, and will open his new pattern shop January 2, 1920, together with Mr. Howard Emery, who was connected with the Aluminum Company for fifteen years, the past eight of which he was plant manager of several of their plants. Mr. Emery is well known to the trade.

OLD PLATING SUPPLY HOUSE SOLD

The Ayer-Kempton Corporation has recently acquired the business and holdings of the Bennett-O'Connell Company of Chicago and the Ayer-O'Connell Manufacturing Company of Meriden, Conn., with general offices at Meriden and factories at Chicago and Meriden. The first meeting of the governing board was held in Meriden January third and the following officers elected: U. S. Ayer, president and treasurer; Arthur W. Kempton, vice-president and secretary; D. W. Ayer, assistant secretary; H. H. Bristol, assistant treasurer for Ayer-O'Connel Division; O. W. Worthington, assistant treasurer for Bennett-O'Connell Division.

The new directors are W. A. Schenck, vice-president Bassick Company; W. B. Church, secretary Meriden Trust Company; Eugene Allen, vice-president 2nd National Bank, New Haven; U. S. Ayer, A. W. Kempton, D. W. Ayer.

Mr. U. S. Ayer was formerly president of the Ayer-O'Connell Manufacturing Company, and vice-president of the Bennett-O'Connell Company, and though but 33 years of age has been active in the polishing and plating industry for fifteen years.

Mr. Arthur W. Kempton, prior to his joining Mr. Ayer in the organization of the Ayer-O'Connell Manufacturing Company, was vice-president of Landers, Frary & Clark, with whom he had been associated nineteen years.

The Ayer-O'Connell division of the Ayer-Kempton Corporation have just moved into their new five story plant in Meriden and in addition to the manufacture of buffing wheels and compositions will carry a complete stock of generators, lathes, anodes, nickel salts, chemicals, compositions, wiping cloths, and platers' supplies.

The Bennett-O'Connell division of the Ayer-Kempton Corporation will continue to be the Manufacturing Department of Generators, Ball and Babbit Bearing Polishing Lathes, Anodes, Wheels, Brushes, Compositions, and will also carry a complete stock of supplies.

$1,000,000 ALUMINUM PLANT

The U. S. Aluminum Company has just awarded a contract to the Turner Construction Company, New York, for reinforced concrete extensions to their plant at Edgewater, N. J., the total cost of which will amount to over $1,000,000. The Edgewater plant is located on the shores of the Hudson at the foot of the Palisades, directly opposite Grant's Tomb.

The new building is "L" shaped, 81 feet wide, with each wing 450 feet long, and in addition a wing 80 feet by 176 feet. One wing is seven stories, placed on an existing three-story building, making a ten-story building. The other wing is ten, nine and eight stories, the number of stories decreasing because of rising ground at this point. The third wing is three stories.

Total floor area is 452,000 square feet, or about 10.5 acres. These buildings are designed to carry unusually heavy loads, about 500 pounds per square foot. The plans were prepared under the direction of E. S. Fickes, vice-president and chief engineer of the Aluminum company, with C. A. P. Turner as consulting engineer on structural design.

The Aluminum Specialty Company, 17th and Wollmer street, Manitowoc, Wis., has awarded the contract for a two-story, 60 x 200 ft., factory, to be erected on Main street, Chilton, Wis. Estimated cost, $75,000. The main office and plant is at Manitowoc. This is a branch plant. They operate a tool-room, and spinning, stamping and polishing departments.

FINANCIAL STATEMENT OF THE AMERICAN BRASS COMPANY

ASSETS.

	1918.	1919.
Real Estate, Machinery and Tools, January 1	$18,936,877.54	$18,199,359.08
Expended for permanent improvements during the year	3,762,481.54	2,812,816.09
	22,699,359.08	21,012,175.17
Less charged off for Depreciation	4,500,000.00	2,500,000.00
	18,199,359.08	18,512,175.17
Cash	2,081,746.09	3,469,509.41
Bills Receivable	692,818.51	815,593.08
Accounts Receivable	7,530,534.13	8,458,135.00
Wood Lands	229,278.18	252,144.32
Stocks and Bonds owned in other Companies	1,179,146.53	1,232,766.53
Government Bonds owned	3,626,473.53	4,583,361.56
Patents	1,000.00	1,000.00
Merchandise, Raw, Wrought and in Process	14,430,005.05	12,250,638.95
	$47,970,361.10	$49,575,324.02

LIABILITIES.

Capital Stock	$15,000,000.00	$15,000,000.00
Accounts and Bills Payable	1,024,289.07	2,698,587.03
Reserve for Contingencies, Taxes, etc.	10,500,000.00	9,374,524.30
Surplus	17,453,852.42	19,646,072.03
	43,978,141.49	46,719,183.36
Earnings for the Year	3,992,219.61	2,856,140.66
	47,970,361.10	49,575,324.02
Surplus—January 1	20,453,852.42	21,446,072.03
Less Dividends Paid	3,000,000.00	1,800,000.00
	17,453,852.42	19,646,072.03
Earnings for the Year	3,992,219.61	2,856,140.66
Surplus, December 31	21,446,072.03	22,502,212.69

The annual meeting of the stockholders of the American Brass Company will be held in its office at Waterbury, Conn., February 3, 1920.

FOUNDRY EQUIPMENT EXPORT

For the group development of the foundry equipment export trade under the provisions of the Webb Act, the Foundry Equipment Export Corporation has been organized to engage in the sale of all kinds of foundry supplies, equipment and

accessories required by casting manufacturers. The corporation has been incorporated under the laws of Delaware with a capital of $50,000. A temporary office has been established at Room 114, 40 Wall street, New York. The following companies are stockholders of this export corporation:

American Foundry Equipment Co., New York, sand cutting machines and sand blast equipment.

Grimes Molding Machine Co., Detroit, molding machines.

Arcade Mfg. Co., Freeport, Ill., molding machines.

American Molding Machine Co., Terre Haute, Ind., molding machines.

S. Obermayer Co., Chicago, foundry equipment and accessories.

Buch Foundry Equipment Co., York, Pa., molding machines and foundry accessories.

National Engineering Co., Chicago, sand grinding equipment, grinding pans, etc.

E. J. Woodison Co., Detroit, molding machines and foundry supplies.

J. W. Paxson Co., Philadelphia, sand blast machines and other foundry equipment.

Whiting Foundry Equipment Co., Harvey, Ill., sand blast equipment, cleaning room machinery, furnaces, cupolas, etc.

Officers of the Foundry Equipment Export Corp. follow: Col. T. S. Hammond, Whiting Foundry Equipment Co., president; L. L. Munn, Arcade Mfg. Co., first vice-president; E. J. Woodison, E. J. Woodison Co., second vice-president; V. E. Minich, American Foundry Equipment Co., treasurer, and S. T. Johnston, S. Obermayer Co., secretary. The executive committee consists of R. S. Buch, Buch Foundry Equipment Co., V. E. Minich, G. L. Grimes, Grimes Molding Machine Co., S. T. Johnston and the president. Alba B. Johnson, Jr., Morris building, Philadelphia, has been engaged as manager of the corporation. After completing an initial survey of the products manufactured by the stockholders, he will go to Europe where headquarters probably will be established in London, and from which European operations will be conducted. Mr. Johnson has had a wide experience in the export field, particularly in England, France, Russia and South American countries.

JAPAN TO BUY MISSOURI ZINC

Japan will be a large purchaser of American zinc ore if plans of Suzuki & Company, extensive dealers of Kobe, are perfected. For several weeks M. Suzuki was in the Tri-State District looking into the feasibility of purchasing ore. High cost of zinc concentrates in Japan, due to large quantities of lead and iron, make separation difficult and expensive. He believes American zinc ore can be delivered in Japan at less than the native product.

EUROPEAN ZINC MARKET

The American Zinc Institute has issued as a confidential communication to its members the report of an investigation personally made for them by Mr. George C. Stone in respect to the possibilities of Europe as a market for American zinc.

For several years at least the United States seems to be the only country in a position to supply the European demand for slab zinc, unless the price goes too high or present exchange rates are radically changed. The reasons why this is so, including an instructive survey of various foreign smelting plans, are illuminatingly set forth in the report.

Mr. Stone's comments on the uniformity, quality and appearance of slab zinc for export should be read by every American smelterman.

In exact foreign sizes and properly packed and marked, American sheet zinc should be in good demand in European countries. Present conditions even favor the introduction there of American finished roofing plates. (It has recently been shown that American machinery for this purpose can be much more economically operated here than that now in use on the Continent.) The largest use for sheet zinc in Europe is, of course, in building construction, and, strange as it may be, this field seems to be capable of worth while expansion by way of the United States. The American Zinc Institute, through the courtesies extended to Mr. Stone, while abroad, is adopting methods which have made so general the use of zinc for construction purposes there. The institute is already telling the American public that zinc for building purposes is moderate in cost, light, easily worked and long lived.

American lead free oxide and, at least for a while, lithopone should also have a European export demand.

Belgium, despite the pessimistic forecast of a year ago, will probably react in every way more quickly than any of her allies; in fact, while conditions there are far from normal, the optimism of the Belgians is in marked contrast to that of the others.

The questions of foreign exchange, transportation and labor and their bearing upon American zinc exportations are fully discussed in the report.

The report also comments upon the probable influence of the operations of the existing Burma Corporation and an enlarging Tasmanian zinc plant and of the proposed Tonkin Zinc Works upon the international zinc business, especially with respect to America and Europe.

BRASSWORKERS DEMAND SANITATION

On December 9 a deputation of the International Metal Polishers' and Brassworkers' waited on the Hon. Walter Rollo, Minister of Labor and Health for the Province of Ontario, urging the appointment of a man by the Government who will inspect blower and ventilation systems in metal and brassworking shops. It was pressed forward by Donald Wright on health grounds. It is probable that some legislation will be passed on the subject at the next session.

TRADE CATALOGUES

Sand Blasting—a pamphlet of testimonials for the Pangborn Land Blast Machines.

Monel Metal—a very instructive booklet issued by the Monel Metal Products Corporation, Bayonne, N. J.

Seamless Brass and Copper Tubing—a data sheet and price list from the Rome Hollow Wire and Tube Company, Rome, N. Y.

Foundry Supplies—The Obermayer Bulletin, issued monthly by the S. Obermayer Company, Chicago, Ill.

Lacquer and Enamels—an attractive catalogue, properly illustrated by the Celluloid Zapon Company, 200 Fifth Avenue, New York City.

Rolling Mill Machinery—An elaborate and interesting catalogue from the Philadelphia Roll & Machine Company, Philadelphia, Pa.

Scientific Apparatus—an unusually handsome catalogue of the Holz Universal Photo-Micrographic and Macrographic Metallographic Bend. Bulletin No. 22-23, issued by Holz & Company, Inc., 17 Madison Avenue, New York City.

Furnaces and Furnace Appliances.—Leaflets Nos. 200 and 207, the former illustrating and describing typical shipyard angle and plate heating furnaces; the latter, handling devices in the heat-treating room, from W. S. Rockwell Company, New York City.

A new bulletin entitled **"Lane Electric Cranes,"** has been issued by N. B. Payne & Co., 25 Church St., New York City, sole agents for Lane Electric Cranes manufactured in Montpelier, Vt., by the Lane Mfg. Co. The bulletin fully illustrates and describes several styles of cranes in which steel girders or heavy timbers of long leaf yellow pine are use. The bulletin contains a complete set of specifications and a questionnaire which is inserted for the use of the prospective purchaser on which he can quickly write all information needed by the manufacturers. A free copy will be mailed upon request by N. B. Payne & Co., to any reader of this publication.

PRINTS

New Year's Greetings—a bright pamphlet with a cheery "Hello" from A. L. Heasis of the Joseph Dixon Crucible Company, Jersey City, New Jersey.

Calendars from the Cleveland Brass & Copper Mills, Cleveland, O., The General Electric Company, and E. A. Williams & Son, Jersey City, N. J.

Pyrometers—A catalogue from the Brown Instrument Company, Philadelphia, Pa., gives valuable information regarding Pyrometry, Resistance Thermometers, Recording Thermometers, Pressure Gauges, Draft Gauges, Tachometers, Time and Operation Recorders and other instruments of the Brown line.

A handsome 1920 calendar has been issued by the **American Brass Company,** of Waterbury, Conn. The calendar has colored illustrations of the six mills operated by the American Brass Company, located in the different industrial sections of the country. Three months of time are recorded on each page—the present, past and future—and the top is appropriately bound by a nicely finished brass rule, indicating, of course, that the calendar originated in the primeval brass city—Waterbury.

METAL STOCK MARKET QUOTATIONS

	Par.	Bid.	Asked.
Aluminum Company of America	$100	$525	$525-625
American Brass	100	220	224-229
American Hardware Corp.	100	157	149-154
Bristol Brass	25	34	32-35
International Silver, com.	100	30	30-40
International Silver, pfd.	100	92	94-98
New Jersey Zinc	100	240	268-273
Rome Brass & Copper	100	280	280-320
Scovill Mfg. Co.	100	400	395-415
Yale & Towne Mfg. Co.	...	250	260-280

Corrected by J. K. Rice, Jr., & Co., 26 Wall Street, New York.

METAL MARKET REVIEW OF 1919—OUTLOOK FOR 1920

WRITTEN FOR THE METAL INDUSTRY BY W. T. PARTRIDGE.

The year 1919, immediately following the World's Great War, will be looked upon in retrospect as a most critical period; a year of high tension in American finance. A life-and-death struggle between shifting and turbulent currents in the foreign situation which taxed to the uttermost, the views of every business man of importance, compelling him to drop old ideas and to adjust his thoughts to an international viewpoint in trade in order to keep abreast of rapidly changing events. An anxious year, indeed, it was; distinguished from every other year, in the importance of pending decisions affecting everybody, everywhere, in the settlement of its momentous war problems.

The League of Nations, the ratification of Peace too long delayed, European loans, depreciation in monetary values of exchange rate, wild speculation in this country which was checked by our admirable Federal Reserve system just in time to prevent a serious crash here, were among the most important events affecting trade and commercial relations. While overshadowing all these problems, to be satisfactorily solved, hung lowering clouds of social unrest that darkened the entire world with a threatening storm of violence. This was manifested in the extreme, by the I. W. W. organizations and Bolshevistic activities. Unionism in labor, surprised the ordinary thinker by developing into a menace, a force seeking to deprive the individual worker of his liberty to act upon his own initiative and compelling him to accept the dictum of Union leaders as to when and where he might work and the recompense which he might accept for that work. Business in many lines was halted as never before and the coal strike placed in jeopardy the lives of thousands of people by depriving them of fuel in bitterly cold weather.

Notwithstanding all these restricting and discouraging influences, international world commerce in all lines, it is estimated by banking authorities approximated in value, 70 billions of dollars. This is an increase of 10 billions in value over world trade in 1918, which eclipsed all previous records and established the United States as the creditor nation in the world's markets, a position likely to be maintained far into the future years. Since world trade estimates are based upon an aggregation of the exports of every country plus the imports of every country, it is well to bear in mind that the actual value of international trade is only one-half the value in merchandise moved, because exports to one country become imports into another country, which exactly doubles the figures in the aggregate record of valuations.

Almost every country in 1919, for which figures are available, shows a substantial increase over figures of 1918. Estimates of United States total trade for the calendar year closely approximate $12,000,000,000, as compared with $9,400,000,000 in 1918. How much of this increase in valuation is due to higher prices, it is not yet possible to determine. Exports are valued at $8,000,000,000, while the value of imports is placed at close to $4,000,000,000, indicating a favorable trade balance of $4,000,000,000 for this country. Exact figures are not yet available. It is interesting to note that British world trade is also estimated at $12,000,000,000, with the proportion of imports two-thirds of its entire volume and the exports one-third. United States trade volume exactly reverses this, its exports being two-thirds of the entire volume and its imports one-third.

This country advanced nearly $10,000,000,000 in credits to European countries indicating a net gain on their gold settlements approximating $700,000,000, or 10 per cent. of the difference between total war trade balances and our public loans. With the Edge bill become a law and the Exchange situation slowly becoming more nearly stabilized, indications point to the adoption of adequate measures being established which will place foreign clients of American firms upon a sound financial basis in the not too remote future.

Exports and imports in November set new high marks in the history of our foreign trade operations, according to Department of Commerce statistics, the value of exports for the month being $741,000,000, as compared with $552,000,000 in the same month in 1918. Imports last November were valued at $429,000,000. For the 11 months ending November 30, total valuation of exports is placed at $7,242,000,000, while total imports are valued at $3,528,000,000.

The valuation of metals produced in 1918 in this country, according to Geological Survey was 3 per cent. greater than in the previous year. More copper, but less zinc was produced, the values of each being lower. Less gold and silver were mined than in many years, but prices were below costs of production. Total mineral production exceeded half a billion, the figures being $5,526,000,000, showing an increase over the previous year, although the quantity produced was not so great.

Metals trades in 1919 were all more or less hampered by the many perplexities arising as a result of the abrupt ending of the war and the delay in ratification of the peace treaty, which is not yet accomplished. Large quantities of surplus war stocks had to be disposed of, the cancellation of heavy Government contracts required time in their adjustment of fair values to cover losses incurred. Rapidly fluctuating exchange rates carrying to new low records in the case of all foreign monetary values made business more than difficult, while the trouble caused by lack of shipping facilities was increased by labor strikes at docks which held up ocean freight. Transportation traffic within our own borders was also seriously interfered with by strikes and the lack of sufficient equipment to carry freight, all due to the inefficiency and shortsightedness of the Administration's control.

All things considered, therefore, the volume of business transacted during the year is surprising. Total sales of copper, according to reliable trade estimate, approximated 1,800,000,000 pounds, at prices which ranged from 21.50c. January 1 to 18.50c. per pound December 31, for prompt electrolytic. Transactions in the tin market were enormous, deliveries into American consumption being estimated 32,301 tons at prices that ranged from 72.50c. (Government fixed price) January 1 to 58.75c. December 31, for spot Straits metal in New York. Business in zinc surpassed all expectations, but was largely on foreign account. Prices advanced from 8.00c. per lb. January 1 to 9.25c. December 31, the highest figure of the year. The lowest price touched was in May, at 6.35 c. for prompt Western shipment primary spelter New York. Producers' price of lead January 1, 1919, was 6.00c. per lb., the open market being 5.75c. At the end of the year producers' had advanced to 7.50c., the open market being 7.50-7.75c. The lowest figures of the year were 4.60c. open market and 5.00c. "Trust" price in May. Heavy sales, following depression during first quarter of the year, combined with decreased production resulted in a scarcity of lead during the last quarter. The demand for antimony was greater than in pre-war years

and prices which on January 1 were 7.62½-7.75c. duty paid New York, were on December 31 exactly 2.00c. per lb. higher for spot metal. Price fluctuations in the aluminum market were wholly due to resales of importations from Italy, France and Scandinavia, the lowest point being 28c. in March. Producers' prices were maintained at 32-33c. throughout the year, with entire capacity sold for 1920 delivery. Silver prices, due to increasing scarcity advanced from the fixed "agreed upon" price, $1.01⅛, which prevailed over first quarter to a new high record at $1.37½ per ounce in November. At the end of the year quotations were $1.31 per ounce. Quicksilver was in steady demand, prices being wholly dependent upon supplies held at the moment. The highest figures of the year were $115 per flask in January, the lowest being $68 per flasked touched in March and also in April. On December 31 quotations were $85 per flask of 75 lbs. each. Platinum was in ever-increasing demand with prices that advanced from the lowest figure, $98 per ounce in January to $160 per ounce in December. Old metals followed the trend of the major metals, but the volume of business transacted was not so large as was expected by dealers.

The past year yielded better results than conditions now known, would have seemed to indicate, if known at the beginning of the year. The outlook for 1920 in metals industry is most promising and at prices that are likely to rise to higher levels before any permanent decline occurs.

COPPER.

Production of refined copper in 1919, the smallest since 1915, is estimated in the trade to have been 1,800,000,000 pounds, as compared with 2,500,000,000 output in 1918. Stocks of refined metal at the beginning of 1919 were 180,000,000 pounds, which added to current production during the year indicates the available supply to have been 1,984,000,000 pounds, and closely approximating estimated total sales, 1,800,000,000 pounds, made on domestic and foreign account. Deliveries into domestic consumption were about 1,200,000,000 pounds. Stocks of refined copper at the end of 1919 were probably 240,000,000 pounds and in addition to the refined supply, blister copper and material in process of refinement or in transit are supposed to equal about 466,000,000 pounds. Exports during the year with estimates based upon Government returns, which, however, are not yet complete, were 541,000,000 pounds. this being the smallest outgo in the past twelve years. Importations approximated 426,000,000 pounds, being the smallest since 1915.

Government control of the industry came to an end January 1, 1919, and prices in the absence of demand from either domestic consumers or from foreign buyers, almost immediately declined from the Government fixed price, 26.50c. per pound. To stimulate business into normal activity, the Copper Export Association was formed and late in January sent a Commission abroad to canvass the situation. While producers held prices nominally at 23.50c., the decline in the open market, by the end of February, had carried to 16.50c. for prime Lake, to 15.25c. for electrolytic and to 14.87½c. for casting copper, all prompt deliveries. In order to reduce heavy surplus stocks production was cut in half, general operations being reduced 50 per cent. at a majority of plants and by the beginning of April, prices had recovered ½c. per pound.

Government war surplus was disposed of by agreement with producers who appointed the United Metals Selling Co. their representative and by which sales of Government stocks equal to 10 per cent. of sales made on producers' account, disposed of the entire quantity by end of first half of the year, although a time limit of 15 months had been agreed upon. Wire drawers and electrical equipment manufacturers, in May, made large purchases and exports amounted to 30,000,000 pounds, prices made a net advance of 1⅛c. per pound.

Producers' sales over first half of the year were approximately 700,000,000 pounds, exports being 215,000,000 pounds. Prices at the beginning of second half had recovered to 19c. for Lake, 18.50c. for electrolytic and 17.87½c. for casting, all prompt deliveries, while future positions were held at ¼c. per pound premiums. July sales were heavy and prices advanced to producers' figures, 23@24c. for Lake, 23.50@23.75c. for electrolytic and 22.75c. for casting copper, prompt and nearby shipments. Sales in August were only about one-half the tonnage disposed of in July, but producers maintained prices unchanged. In the outside market, however, prices were shaded in the effort to make sales.

During the fall months, labor disturbances and railroad embargoes, due to congested freight traffic, interfered with deliveries and restricted all business generally, and prices declined 5¼c. per pound in both markets after producers in October had abandoned their previously firmly held prices, and entered into competition for business. During December business became very active and prices, after holding steadily at 19c. for Lake, 18.50c. for electrolytic and 18.25c. for casting; prompt deliveries, with ¼c. premiums each on January, first quarter and second quarter positions, were advanced ¼ to ½c. on all kinds and on all positions. Domestic consumption in the last half of the year was larger than had been anticipated and approximated closely to 100,000,000 pounds, according to producers' estimates.

TIN.

Government restrictions and the fixed price, 72.50c. per pound, in the tin market were not removed until late in June, 1919, when all purchases made by the Government through the U. S. Steel Products Co. had been disposed of. American pure tin, however, made from imported Bolivian ores, was available during the first half of the year at prices ranging from 68 to 71.50c. per pound, while American 99 per cent. metal could be purchased at from 66 to 69c. per pound. With an open market established by July 1, prices of Straits metal declined to 70-71c., while American metal was held at 65-67c. per pound. Heavy arrivals of Straits, English L. & F. and some Banca tin in the next few months caused a drop of from 13c. to 15.50c. per pound. Spot Straits was obtainable at 55.75 to 56c. per pound, while American metal could be purchased at from 55.37½ to 55.50c.

The longshoremen's strike in the fall, was particularly felt in the tin market because of the heavy stocks on ships in the harbor and on ships about to land. Premiums for available spot metal ranging from ¼ to 2c. per pound, according to urgency of buyers' need for quick delivery, were paid, but with the strike settled and better conditions generally in business, the pressure was relieved. Continued heavy arrivals, despite the large volume of business transacted, brought about a decline by the end of November, when Straits was selling at 54.25c., American pure at 54.50c. and 99 per cent. metal at 53.50c. per pound. For some reason not fully understood in this country, the London and Singapore markets, in December, advanced rapidly, and whether due to expected shortage of supplies in those markets, or not, the market here was sympathetically affected. Prices by the end of the month had advanced 5.50c. per pound to 59¾. Total deliveries into domestic consumption during the year were 32,301 tons, while arrivals at both Atlantic and Pacific ports were 35,404 tons.

LEAD.

In an effort to establish normal conditions, following the war, the lead industry acted promptly in reducing output to 50 per cent. of wartime operations. Prices, from time to time, were cut during the first quarter of the year, by the leading interests until 4.75c. E. St. Louis, 5.00c. New York were quoted on April 9, these being the lowest figures of the year. In the outside market, prices ranged, during this time, within from 5 points to 15 points, either above or below the "Trust" figures, depending upon the quantity of lead available for such sales. By May 16, sufficient progress had been made to warrant a 10-point advance in the basis of the leading interest, after which, over the remainder of the year, 12 advances were made, the last being on December 26, to 7.25c. E. St. Louis, 7.50c. New York. Outside prices, however, continued to rise, 7.37½-7.50c. E. St. Louis, 8.00c. New York being quoted December 31. Lead ores, after dropping to $60 per ton, recovered in December, to $90 per ton. A very large volume of business was transacted and the outlook for 1920 was most encouraging.

ZINC.

Continued increase in production, notwithstanding heavy accumulation of stocks in the spelter industry at the beginning of 1919, acted as a serious handicap until far into the year. Lack of demand from domestic consumers, with no prospect of export trade, in the early months, were discouraging features and prices declined, until in May, when the lowest quotations of the year were made, 6.00c. E. St. Louis, 6.35c. New York. A gradual improvement was noted in June, largely due to foreign buying that continued at intervals thereafter and culminated in November and December in very active buying on both foreign and domestic account, and when prices advancing rapidly reached 8.85c. E. St. Louis, 9.20c.-9.30c. New York at the end of the year, these being the highest quotations in 1919.

ALUMINUM.

Throughout 1919 there was an active demand for aluminum, fluctuations in prices being almost wholly due to Government stocks sold at prices below the basis of the Aluminum Company of America's schedule of prices, which were maintained throughout the year at 32c.-33c. for virgin ingots; 31c.-32c. for 98-99% remelted; 29c.-30c. for No. 12 remelted, and 42.20c. for sheets 18ga. and heavier. Not only were United States Government stocks sold in this market—at prices as low as 22c. for sheets—but French, British and Italian stocks were disposed of. The lowest figures in the open market were 30.50c. for ingots, reached in August when French and Italian metal were in the market. In December, importations of British metal caused a weaker tone, with some shading of prices 32c. being the lowest on actual sales of ingots, although bids were in the market at 31.50c. Entire output of the Aluminum Company of America was reported sold to regular customers at schedule prices.

ANTIMONY.

Heavy surplus stocks of antimony, regarded as a menace to prices at the beginning of 1919, were entirely absorbed by large buyers by the end of June. The volume of business during the year was in excess of pre-war transactions and prices were well maintained, the lowest figures being 6.50c., duty paid New York, for prompt wholesale in April, as compared with 7.50c. at the beginning of the year, and with 9.62½c. at the end. Shipments from the Orient were difficult to purchase, being nominally held at or slightly above the New York parity throughout the year. A few occasional offerings of special lots, at prices slightly below the equivalent here, were quickly taken whenever such offerings were made.

SILVER.

Unabated and increasing world demand for silver combined with decreasing output, carried prices of the metal to a new maximum record, $1.37½ in November, after which there were fluctuations ranging as low as $1.30, with $1.31 per ounce the quotation December 31. Exports in the eleven months ending November 30, 1919, were $208,426,260, as compared with exports over corresponding period in 1918 of $204,540,288. Importations over first eleven months in 1919 were $79,725,206, as compared with $67,045,454 in 1918.

QUICKSILVER.

Demand for quicksilver in 1919 was well maintained throughout the year, prices fluctuating from $115, at the beginning, to as low as $68 per flask, touched in March and again in April. From that time on, fluctuations were between $75 and $109 per flask, depending upon the quantity available in the market. Production in 1919 is estimated at not more than 20,500 flasks. Stocks on hand at end of 1919 were 2,185 flasks, as compared with 2,800 flasks at end of first quarter of the year.

PLATINUM.

Active demand and decreasing supplies of platinum, caused prices to rise $62 per ounce during the year. Stocks held by the Government at the beginning of the year were released gradually and by the end of January sales were being made in the open market at $98@100 per ounce, this being a recession of $5 per ounce from the maximum Government price, $105 per ounce for pure. After remaining unchanged at these figures during first quarter, a recovery was made in May to $105 per ounce. Increasing scarcity and increasing demand, over remainder of the year, carried prices upward to $160 per ounce on December 24, there being no change thereafter. Total importations during first ten months 1919 were 45,849 troy ounces, as compared with 46,150 ounces in the corresponding period 1918.

OLD METALS.

Business in old metals during 1919 followed the course of major metals, but on the whole was not so large in volume as was anticipated at the beginning of the year. This was largely due to the entire absence of foreign buying. Coppers, brass clean red car boxes and faucets were all up 1c. per popnd, pewter advanced 4c. to 8c. and block tin pipe to 2c. to 7c. Aluminums were all up ½c. Other items listed, advanced from ¼c. to ¾c. per pound.

WATERBURY AVERAGE

Lake Copper. Average for 1918, 24.75. 1919—January, 23.00. February, 18.00. March, 15.50. April, 15.50. May, 16.37½. June, 17.75. July, 22.00. August, 22.00. September, 22.50. October, 22.25. November, 21.00. December, 18.75.

Brass Mill Zinc. Average for 1918, 9.858. 1919—January, 9.00. February, 8.20. March, 8.00. April, 6.90. May, 6.80. June, 7.25. July, 8.10. August, 8.10. September, 7.85. October, 8.15. November, 8.55. December, 9.05.

DECEMBER MOVEMENTS IN METAL

	Highest.	Lowest	Average.
Copper:			
Lake	19.50	18.00	18.88
Electrolytic	19.00	18.00	18.483
Casting	18.50	17.50	18.215
Tin	58.25	52.125	54.221
Lead	8.00	6.75	7.221
Zinc (brass special)	9.10	8.15	8.465
Anitomy	9.625	9.25	.562
Aluminum	33.00	32.00	32.50
Quicksilver (per flask)	$100.00	$85.00	$94.886
Silver (cts. per oz.)	134	129½	131.97

INQUIRIES AND OPPORTUNITIES

Under the directory of "Trade Wants" (published each month in the rear advertising pages), will be found a number of inquiries and opportunities, which, if followed up, are a means of securing business. Our "Trade Want Directory" fills wants of all kinds, assists in the buying and selling of metals, machinery, foundry and platers' supplies, procures positions and secures capable assistants. See Want Ad. page.

Metal Prices, January 19, 1920

NEW METALS

	Cents.
COPPER—DUTY FREE. PLATE, BAR, INGOT AND OLD COPPER. Manufactured 5 per centum.	
Electrolytic, carload lots	19.25
Lake, carload lots	20.
Casting, carload lots	19.25
TIN—Duty Free.	
Straits or Australian, carload lots	65.
LEAD—Duty Pig, Bars and Old, 25%; pipe and sheets, 20%. Pig lead, carload lots	8.25
ZINC—Duty 15%.	
Brass Special	9.75
Prime Western, carload lots	9.50
ALUMINUM—Duty Crude, 2c. per lb. Plates, sheets, bars and rods, 3½c. per lb.	
Small lots, f. o. b. factory	...
100-lb. f. o. b. factory	...
Ton lots, f. o. b. factory	32-33
ANTIMONY—Duty 10%.	
Cookson's, Hallet's or American	Nominal
Chinese, Japanese, Wah Chang WCC, brand spot	10.25
NICKEL—Duty Ingot, 10%. Sheet, strip and wire, 20% ad valorem.	
Ingot	.43
Shot	.43
ELECTROLYTIC	.45
MANGANESE METAL	Nominal
MAGNESIUM METAL—Duty 20% ad valorem (100 lb. lots)	$1.90
BISMUTH—Duty free	Nominal $2.95
CADMIUM—Duty free	Nominal $1.40
CHROMIUM METAL—Duty free	Nominal
COBALT—97% pure	$3.00
QUICKSILVER—Duty 10% per flask of 75 pounds	$93 00
PLATINUM—Duty free, per ounce	$160.00
SILVER—Government assay—Duty free, per ounce	$1.37
GOLD—Duty free, per ounce	$20.67

Metal Prices, January 19, 1920

INGOT METALS

Silicon Copper, 10%	according	to	quantity	39	to44
Silicon Copper, 20%	"	"	"	40	to45
Phosphor Copper, guaranteed 15%	"	"	"	26	to33
Phosphor Copper, guaranteed 10%	"	"	"	25	to32
Manganese Copper, 30%	"	"	"	60	to70
Phosphor Tin, guarantee 5%	"	"	"	69	to75
Phosphor Tin, no guarantee	"	"	"	80	to85
Brass Ingot, Yellow	"	"	"	14½	to16½
Brass Ingot, Red	"	"	"	20	to22
Bronze Ingot	"	"	"	22	to24
Parsons Manganese Bronze Ingots	"	"	"	22	to24
Manganese Bronze Castings	"	"	"	32	to42
Manganese Bronze Ingots	"	"	"	19	to23
Manganese Bronze Forgings	"	"	"	30	to40
Phosphor Bronze	"	"	"	24	to30
Casting Aluminum Alloys	"	"	"	32	to34

OLD METALS

Buying Prices.		Selling Prices.
17½to18	Heavy Cut Copper	19 to19½
17 to17½	Copper Wire	18½to19
15 to15½	Light Copper	17 to17½
16½to17	Heavy Machine Comp	18 to18½
12 to12½	Heavy Brass	13 to13½
9½to10	Light Brass	11 to11½
9½to10	No. 1 Yellow Brass Turnings	11½to12
14½to15	No. 1 Comp. Turnings	16½to17
4.75	Heavy Lead	5.40
4.75	Zinc Scrap	5.50
10.50to13½	Scrap Aluminum Turnings	11.50to14.50
21.50to23½	Scrap Alumnium, cast alloyed	24.00to25.50
24.50	Scrap Aluminum, sheet (new)	27.00
36.50	No. 1 Pewter	40.50
18.50	Old Nickel anodes	20.50
26.50to28½	Old Nickel	30.50to32.50

BRASS MATERIAL—MILL SHIPMENTS

In effect Dec. 1, 1919.

To customers who buy 5,000 lbs. or more in one order.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.25¼	$0.27¼	$0.29
Wire	.25¼	.27¼	.29
Rod	.23¾	.28	.30
Brazed tubing	.37	..	.41¾
Open seam tubing	.37	..	.41¾
Angles and channels	.38	..	.42¾

To customers who buy less than 5,000 lbs. in one order.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.26½	$0.28½	$0.30¼
Wire	.26½	.28½	.30¼
Rod	.25	.29¼	.31¼
Brazed tubing	.38¼	..	.43
Open seam tubing	.38¼	..	.43
Angles and channels	.39¼	..	.44

SEAMLESS TUBING

Brass, 30½c. to 32½c. per lb. base.
Copper, 32c. to 34c. per lb. base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod	29½c.	net	base
Muntz or Yellow Metal Sheathing (14"x48")	25¾c.	"	"
Muntz or Yellow Rectangular Sheets other than Sheathing	26¾c.	"	"
Muntz or Yellow Metal Rod	23¾c.	"	"

Above are for 100 lbs. or more in one order.

COPPER SHEET

Mill shipments (hot rolled)	29½c. net base
From stock	31½c. " "

BARE COPPER WIRE—CARLOAD LOTS

22¾c. to 23¼c. per lb. base.

SOLDERING COPPERS

300 lbs. and over in one order	31½c. per lb. base
100 lbs. to 300 lbs. in one order	32½c. " " "

ZINC SHEET

Duty, sheet, 15%. Cents per lb.

Carload lots, standard sizes and gauges, at mill, 12c. basis, less 8 per cent.

Casks, jobbers' prices	14c.
Open casks, jobbers' prices	14½c.

ALUMINUM SHEET AND ROD

Sheet Aluminum, base price, 48c. per lb. Coils, 44c. per lb.

ROD.

B. & S. Gauge.

¼" to 1" Advancing by 32nds
1" to 2⅝" " " 16ths } 98% rolled, 43.10 cents per lb.
2⅝" to 3½" " " 8ths

⅜" to ¼", 98% rolled and drawn.....48.80 cents per lb.

BLOCK TIN SHEET AND BRITANNIA METAL

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker. 100 lbs. or more, 10c. over Pig Tin. 50 to 100 lbs., 15c. over 25 to 50 lbs., 17c. over, less than 25 lbs., 25c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 500 lbs. or over at N. Y. tin price, 100 lbs. or more, 5c. over Pig Tin. 50 to 100 lbs., 12c. over, 25 to 50 lbs., 15c. over, less than 25 lbs., 25c. over.

Above prices f. o. b. mill.

Prices on wider or thinner metal on request.

LEAD FOIL

Base price—figured on base price of lead at the time.

PLATERS' METALS

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturer.

SILVER SHEET

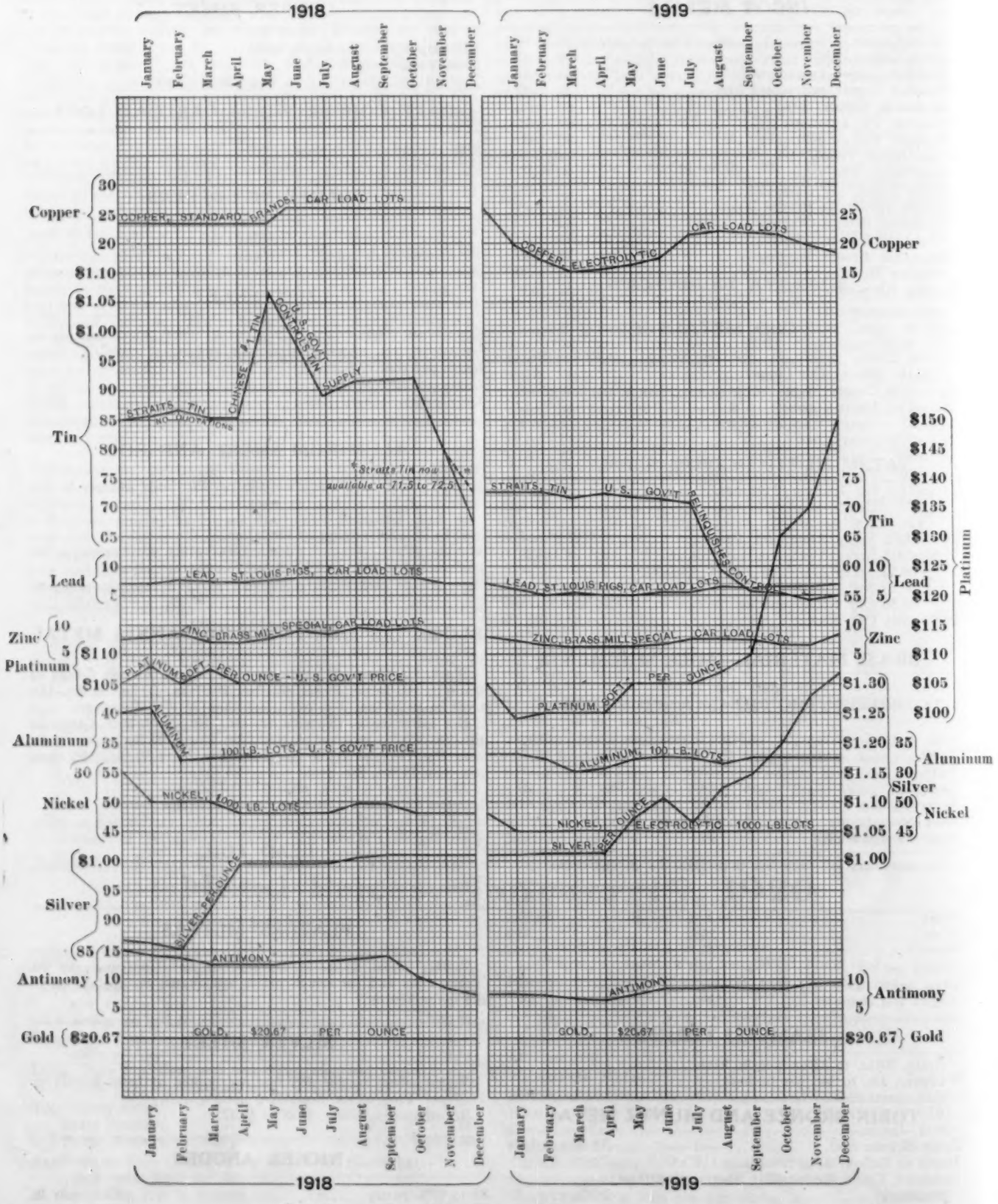
Rolled silver anodes .999 fine are quoted at from $1.3475 to $1.37 per Troy ounce, depending upon quantity.

Rolled sterling silver, $1.28 to $1.32.

NICKEL ANODES

85 to 87% purity	.55c.	per lb.
90 to 92% "	.57½c.	per lb.
95 to 97% "	.60c.	per lb.

CHART OF METAL PRICES FOR 1918-1919



Pig Iron and Metal Products of the United States

Calendar Years 1910-1918. (1919 Estimated)

(FROM THE UNITED STATES GEOLOGICAL SURVEY.)

PRODUCTS — Metallic.	1910 Quantity.	1910 Value.	1911 Quantity.	1911 Value.	1912 Quantity	1912 Value.	Products.
Pig iron (spot value), long tons	26,674,123	$412,162,486	23,257,288	$327,334,624	30,180,969	$420,563,388	Pig iron
Silver, commercial value, troy ounces	57,137,900	30,854,500	60,399,400	32,615,700	63,766,800	39,197,500	Silver
Gold coining value, troy ounces	4,657,018	96,269,100	4,687,053	96,890,000	4,520,717	93,451,500	Gold
Copper, value at New York City, pounds	1,080,159,509	137,180,257	1,097,232,749	137,154,092	1,243,268,720	205,139,338	Copper
Lead, value at New York City, short tons	375,402	33,035,376	391,995	35,279,550	392,517	35,326,530	Lead
Zinc, value at St. Louis, short tons	252,479	27,267,732	271,621	30,964,794	323,907	44,699,166	Zinc
Quicksilver, value at S. Francisco, flasks	20,601	958,153	21,256	977,989	25,064	1,053,941	Quicksilver
Aluminum, pounds	h47,734,000	8,955,700	h46,125,000	8,084,000	h65,607,000	11,907,000	Aluminum
Antimonial lead, short tons	14,069	1,338,090	14,078	1,380,556	13,552	1,311,348	Antim. L'd
Nickel, value at New York, pounds	†	†	890,000	127,000	†	†	Nickel
Tin, pounds	.....	23,447	.....	56,635	.....	124,800	Tin
Platinum, value at New York City, troy ounces	773	25,277	940	40,890	1,005	45,778	Platinum
Total value of metallic products (b)	.....	$749,876,234	.....	$680,888,929	.....	$826,382,073	

PRODUCTS — Metallic.	1913 Quantity.	1913 Value.	1914 Quantity.	1914 Value.	1915 Quantity	1915 Value.	Products.
Pig iron (spot value), long tons	30,388,935	$458,342,345	22,263,263	$298,777,429	30,384,486	$401,409,604	Pig iron
Silver, commercial value, troy ounces	66,801,500	40,348,100	72,455,100	40,067,700	74,961,075	37,397,300	Silver
Gold, coining value, troy ounces	4,299,783	88,884,400	4,572,976	94,531,800	4,887,602	101,035,700	Gold
Copper, value at New York City, pounds	1,224,484,098	189,795,035	1,150,137,192	152,968,000	1,388,009,527	242,902,000	Copper
Lead, value at New York City, short tons	411,878	36,245,264	512,794	39,998,000	507,026	47,660,000	Lead
Zinc, value at St. Louis, short tons	337,252	37,772,224	343,418	35,029,000	458,135	113,617,000	Zinc
Quicksilver, value at S. Francisco, flasks	20,213	813,171	16,548	811,680	21,033	1,804,631	Quicksilver
Aluminum, pounds	h72,379,000	13,845,000	h79,129,000	14,522,700	.....	16,280,000	Aluminum
Antimonial lead, short tons	16,665	1,591,854	16,667	1,572,167	23,224	3,665,736	Antim. L'd
Nickel, value at New York, pounds	481,565	79,393	845,334	313,000	1,644,000	538,222	Nickel
Tin, pounds	(k)	46,699	208,000	66,560	204,000	78,846	Tin
Platinum, value at New York City, troy ounces	1,034	46,530	6,324	280,885	8,665	478,688	Platinum
Total value of metallic products (b)	.....	$883,222,072	.....	$691,081,734	.....	$991,729,648	

PRODUCTS — Metallic.	1916 Quantity.	1916 Value.	1917 Quantity.	1917 Value.	1918 Quantity	1918 Value.	Products.
Pig iron (spot value), long tons	39,126,324	$663,478,118	38,612,546	$1,053,785,975	38,230,440	$1,180,759,656	Pig iron
Silver, commercial value, troy ounces	74,414,802	48,953,000	71,740,362	59,078,100	67,810,139	66,485,129	Silver
Gold, coining value, troy ounces	4,479,056	92,590,300	4,051,440	83,750,700	3,320,784	68,646,700	Gold
Copper, sales value, pounds	1,927,850,548	474,288,000	1,886,120,721	514,911,000	1,908,533,595	471,408,000	Copper
Lead, value at New York City, short tons	552,228	76,207,000	548,450	94,333,000	539,905	76,667,000	Lead
Zinc, sales value, short tons	563,451	151,005,000	584,597	119,258,000	492,405	89,618,000	Zinc
Quicksilver, value at S. Francisco, flasks	29,932	3,768,139	36,159	3,808,266	32,883	3,863,752	Quick'sr
Aluminum, pounds	.....	33,900,000	.....	45,882,000	.....	41,159,000	Alum'm
Antimonial lead, short tons	24,038	4,483,582	18,646	3,781,560	18,570	2,826,350	Ant. L'd
Nickel, value at New York, short tons	918	671,192	402	331,556	441	401,000	Nc'kl(i)
Tin, pounds	280,000	122,000	220,000	135,600	136,000	117,000	Tin
Platinum, value at New York City, troy ounces	28,088	2,301,762	38,831	4,023,757	59,753	6,517,980	Plat'm
Total value of metallic products (b)	.....	$1,620,507,000	.....	$2,086,233,000	.....	$2,153,139,000	

1919 ESTIMATED

PRODUCTS — Metallic.	Quantity.	Value — Total.	Value — Per Unit.
Pig iron, long tons	29,500,000	(i)	(i)
Copper, pounds	1,278,000,000	$243,000,000	19c
Gold, ounces, fine	2,829,395	58,488,800	$20.67
Antimonial lead, short tons	10,000	(i)	(i)
Lead, short tons	430,000	48,396,000	5.8c
Zinc, short tons	459,000	64,260,000	7c
*Quicksilver, flasks	20,750	(i)	(i)
Silver, ounces, fine	55,285,196	61,966,412	$1.12085
*Tin, short tons	50	(i)	(i)

(h) Consumption 1910 to 1914. Production 1915 to 1918.
(i) Figures not available.
(k) Small production from Alaska, South Carolina and South Dakota.
(*) Figures from *Engineering and Mining Journal*. †Values included in total values. May not be shown separately.
(b) Includes some items at minor interest to metal trades not shown in table.

Supply Prices, January 19, 1920

CHEMICALS

Acid—		
Boric (Boracic) Crystals	lb.	.20
Hydrochloric (Muriatic) Com., 20 deg	lb.	.04
Hydrochloric, C. P., 20 deg	lb.	.10
Hydrofluoric, 30%	lb.	.40
Nitric, 36 deg	lb.	7.28
Nitric, 42 deg	lb.	7.90
Sulphuric, 66 deg	lb.	.02½
Alcohol—		
Denatured	gal.	.90
Alum—		
Lump	lb.	.05½
Powdered	lb.	.07
Aluminum sulphate, iron free	lb.	.06
Aluminum chloride solution	lb.	.16
Ammonium—		
Sulphate, tech.	lb.	.07
Sulphocyanide	lb.	—
Argols, white, see Cream of Tartar	lb.	.80
Arsenic, white	lb.	.15
Asphaltum	lb.	.35
Benzol, pure	gal.	.55
Blue Vitriol, see Copper Sulphate.		
Borax Crystals (Sodium Biborate)	lb.	.09½
Calcium Carbonate (Precipitated Chalk)	lb.	.15
Carbon Bisulphide	lb.	.08
Chrome Green	lb.	—
Cobalt Chloride	lb.	2.00
Copper—		
Acetate (Verdigris)	lb.	.60
Carbonate	lb.	.29
Cyanide	lb.	.65
Sulphate	lb.	.09
Copperas (Iron Sulphate)	lb.	.04
Corrosive Sublimate, see Mercury Bichloride.		
Cream of Tartar, Crystals (Potassium bitartrate)	lb.	.80
Crocus	lb.	.15
Dextrin	lb.	.25
Emery Flour	lb.	.10
Flint, powdered	ton	—
Fluor-spar (Calcic fluoride)	ton	—
Fusel Oil	gal.	5.50
Gold Chloride	oz.	14.00
Gum—		
Sandarac	lb.	—
Shellac	lb.	—
Iron Sulphate, see Copperas	lb.	.04
Lead Acetate (Sugar of Lead)	lb.	.25
Yellow Oxide (Litharge)	lb.	.20
Mercury Bichloride (Corrosive Sublimate)	lb.	1.92
Nickel—		
Carbonate Dry	lb.	.80
Chloride	lb.	.55
Salts, single bbl	lb.	.17
Salts, double bbl	lb.	.15
Paraffin	lb.	.20
Phosphorus—Duty free, according to quality		—
Potash, Caustic, Electrolytic 88-92%, fused	lb.	.32
Electrolytic 70-75%, fused	lb.	.26
Potassium Bichromate	lb.	.35
Carbonate, 90-95%	lb.	.30
Cyanide, 98-99½%	lb.	—
Pumice, ground	lb.	.05
Quartz, powdered	ton	—
Official	oz.	—
Rosin	lb.	.08½
Rouge, nickel	lb.	.40
Silver and Gold	lb.	.60
Sal Ammoniac (Ammonium Chloride)	lb.	.18
Sal Soda	lb.	—
Silver Chloride, dry	oz.	1.43
Cyanide	oz.	—
Nitrate, 100 ounce lots	oz.	.84
Soda Ash, 58%	lb.	.04
Sodium—		
Biborate, see Borax	lb.	.09½
Bisulphite	lb.	.08
Cyanide, 96 to 98%	lb.	.25
Hydrate (Caustic Soda)	lb.	.06
Hyposulphite	lb.	.04
Nitrate, tech.	lb.	.06
Phosphate	lb.	.14
Silicate (Water Glass) bbls	lb.	.03
Sulpho Cyanide	lb.	.90
Soot, Calcined	lb.	—
Sugar of Lead, see Lead Acetate	lb.	.25
Sulphur (Brimstone)	lb.	.03
Tin, Chloride	lb.	.65
Tripoli Composition	lb.	.02½
Verdigris, see Copper Acetate	lb.	.60
Water Glass, see Sodium Silicate, bbls	lb.	.03
Wax—		
Bees, white ref. bleached	lb.	—
Yellow	lb.	.60
Whiting	lb.	.05
Zinc, Carbonate	lb.	.24
Chloride	lb.	.15
Cyanide	lb.	.45
Sulphate	lb.	.05

COTTON BUFFS

Open buffs, per 100 sections (nominal).		
12 inch, 20 ply, 64/68, cloth	base,	$100.00
14 " 20 " 64/68, "	"	120.00
12 " 20 " 84/92, "	"	136.05
14 " 20 " 84/92, "	"	183.30
Sewed buffs, per pound.		
Bleached and unbleached	"	.70

FELT WHEELS

		Price Per Lb.
White Spanish—		
Diameter— 6" to over 16"	Thickness—½" and ¾"	$4.00
" 6" and 8"	" 1" to 3"	3.35
" 10" to 16"	" 1" to 3"	3.25
" over 16"	" 1" to 3"	3.35
" 6" to over 16"	" over 3"	3.40
Grey Mexican—		
Diameter— 6" to over 16"	Thickness—½" and ¾"	$3.90
" 6" and 8"	" 1" to 3"	3.25
" 10" to 16"	" 1" to 3"	3.15
" over 16"	" 1" to 3"	3.25
" 6" to over 16"	" over 3"	3.30